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— The general statement is exceptionally good. RKW

THIRTIETH ANNUAL REPORT

FOR THE CALENDAR YEAR 1940

Northern
Rocky Mountain
Forest & Range
Experiment Station
Missoula, Montana

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January 1941

GENERAL STATEMENT

The first research assignment in this region was made in December 1908 when W. R. Wheeton was assigned to the Office of Forest Management to initiate forest products investigations. Studies in this field of research have continued uninterrupted in this region since that date. A forest management unit of research was organized in 1911 when the Priest River Experiment Station was established. The first annual station report was made that year. This report, covering the research activities, progress, and results for the calendar year 1940, is the thirtieth in that series. It would seem, therefore, that this is an opportune time to go back and review briefly the progress that has been made towards the solution of the research problems within the region, and to check up on what still remains to be done.

In order to recognize the problems which require research help in their solution and to understand the action taken by this station to meet the need, it will be necessary to paint a brief word picture of the region in which the work is being done.

The northern Rocky Mountain region includes all of Montana, Idaho north of the Salmon River, the three northeastern Washington counties adjacent to the city of Spokane, and Harding County, South Dakota. Out of a gross land area for the region of 110 million acres, 34 million acres are classified as forest land, 61 million acres as pasture and range lands, 12 million acres as crop lands in farms, and 3 million acres as farmsteads, roads, urban, and

waste lands. Forest, pasture, and range lands make up 95 million acres or 85 percent of the gross land area. In addition to an abundance of good soil and water, range forage, and timber, the region was richly endowed with such other natural resources as copper, lead, zinc, silver, gold, coal, and oil. Mining, agriculture, and lumbering have been and must continue to be the three most important industries.

The northern Rocky Mountain region is an inland region. It is relatively remote from the thickly populated manufacturing centers of the Midwest, South, and East. It is scantily populated, having, according to the 1940 census, only around 875,000 inhabitants. There are no large cities or manufacturing centers. It is an exporter of raw or partially manufactured products. It is in direct competition for many of its products with like products in regions to the West and South that have a decided advantage in markets and transportation costs. The future development and continued prosperity of the region depend to a great extent upon economic factors.

The northern Rocky Mountain region can be logically divided into two distinct units based on a broad classification of land use. The unit composed of northeastern Washington, northern Idaho, and that portion of Montana west of the Continental Divide, is known throughout the Pacific Northwest as the Inland Empire region. It is primarily a forested area. Seventy-seven percent of the gross land area is classified as forest land and the unit contains 74 percent of all the commercial forest land and 90 percent of the

commercial sawlog volume within the northern Rocky Mountain region. Today forest industry vies with mining as the second most important industry within the Inland Empire, agriculture holding first rank. The protection, proper management, and best use of this forest resource are the important problems within the unit with which research has been and must be concerned. It must be realized that commercial timber production, though of major importance within this region, is by no means the only use. The forests must be protected and managed from the multiple use standpoint to include recreation and livestock and wild game and fish production. The headwaters of the Columbia River drainage is within the Inland Empire region, making the water conservation and use problem an important one.

Montana, east of the Continental Divide, and Harding County, South Dakota, the remaining portion of the northern Rocky Mountain region not included in the Inland Empire, is primarily an agricultural area where the principal industry is stock raising. Fifty-seven million acres out of the gross land area of 78 million acres is classified as pasture and range lands. There are approximately 10 million acres of crop lands in farm and only 9 million acres or 11 percent of forest land. Certain of the acreage classified as forest land is suitable for the grazing of livestock so the total area available for range and pasture use may be somewhat more than the 57 million acres listed. The proper management and rehabilitation of these range lands present as many serious obstacles and problems as do those of the forest lands in the Inland Empire

region. In the Plains country, where forest growth is limited and slow, such forest products as can be grown are of great importance to the local people. Though the forests in this area are of little commercial importance in the national picture the products, such as farm building material, fenceposts, mine timbers, and fuelwood are of high value to eastern Montana. The main value of the forests, however, is for the protection of the watersheds, water flow, and conservation, recreation, and as a habitat for wild life. The headwaters of the Missouri and the Yellowstone Rivers are within this region, making the water conservation and use problem an important one. Western agriculture depends to a large extent upon irrigation water, so that careful conservation and use of this resource is important.

In 1911 when forest management research was being initiated, lumber was already being produced within the region at the rate of over a billion board feet a year and many of the national forests had large timber sales in operation. The Forest Service had to know "how to cut" and "what to cut" and were doing their best with limited funds and experience to find out. During the first decade (1911-1920) forest research within the region was largely confined to forest management studies in the western white pine type and forest utilization investigations in the commercial timber stands of the Inland Empire. The region had just passed through the disastrous 1910 fire season and there was an immediate timber salvage problem and an in-the-near-future planting problem staring them

in the face. Methods of cutting, nursery and planting, and growth and yield studies comprised the bulk of the work carried on in forest management research during this period. Products men were busy making marketing and mill scale studies, and gathering together the information on production costs and selling values which were so badly needed in the appraisal and sale of national forest timber. It was during this period that most of the forest statistics studies were started, which now furnish us with an unbroken historical record of the amount, the value, and the cost of producing the many forest products produced within the region.

It was not until the second decade (1921 to 1930) that research took a hand in the fire protection problem. Work on this important problem was initiated early in the decade, however, and at its close had already made important contributions. During the decade the work in forest products and utilization continued under the regional forester and branched out further into the field of forest economics. Much valuable information was obtained on the cost of production and the value of the products produced from trees of different sizes and species by means of detailed logging-milling studies. This knowledge was later to form the basic data for selective logging and sustained yield management plans. Forest statistics continued to be obtained at regular intervals and the number of test track, lines, and fences of treated wood in service were increased. The silviculturists continued to study forest management problems in the western white pine type. The work was concentrated on methods of cutting, natural regeneration, and growth and yield.

In 1931 all research work in the region was centered in the station and a division of range research added. It was not until early in this third decade (1931-1940), however, that the forest survey project was initiated within the region. During the decade the inventory was completed in the northeastern Washington and North Idaho units, and the forest resource, depletion, requirements, and growth statistics released. An economic report on the forest situation in the North Idaho unit was also prepared for publication. The inventory was about 80 percent complete for the western Montana unit. Forest Products and Utilization research continued to obtain the regular forest statistical information on production, cost, and value of the products; added much new and valuable knowledge on selective cutting methods in the white pine, ponderosa pine, and larch-fir timber types; studied the economics of the match block industry in the region; and kept abreast of what was new in logging and milling methods and equipment. Some growth and yield studies were made in the larch-fir and ponderosa pine types during the first few years of the third decade by the silviculturists but the bulk of their time was still spent on methods of cutting and natural regeneration problems in the western white pine type. A manuscript summing up all of the past 25 years' accumulation of information on natural regeneration in the type was prepared for publication as a government bulletin. Considerable work was also done on the economic management of the western white pine type and on the major timber management problem of white pine blister rust control. The scope of the methods of cutting studies

was enlarged to include partial cuttings in young white pine stands and in low vigor mature stands subject to heavy bug damage. A new attack was made on the direct seeding phase of the artificial revegetation problem. Research devoted to the forest fire protection problem during this decade improved very materially the efficiency of fire control. The fire danger meter for measuring forest fire danger and the methods of fire control planning to insure the proper distribution of adequate manpower and facilities were outstanding fire research accomplishments. A concerted attack was made during the last two years of the decade to determine accurately the rates of spread of fire through each of the many different timber and fuel types of this region under each of the several broad classes of weather that may and do prevail annually. The influence of altitude and aspect on daily variations in fire danger factors was also being studied and beginning to show results.

Since the station was established in 1911, the research results obtained have been made available to the public in many bulletins, circulars, handbooks, articles, station papers, technical notes, speeches, lectures, and typed manuscripts and progress reports. Nine government bulletins and circulars have been published and five more are now in Washington for review. Some two hundred bulletins, handbooks, circulars, technical articles, and papers have been published in outside publications, and the station itself has duplicated and released some twenty station papers and 106 technical notes. These are in addition to the many typed manuscripts and progress reports (120) on file, and the large number

of mimeographed forest products statistics published quarterly, semiannually, and annually by the division of products, some of them continuously for 27 years. The above publications and manuscripts contain much valuable information and many of the results have found practical application in this and other regions. The station has during the past 30 years worked on the following main forest research projects:

1. Logging output studies
2. Financial aspects of logging and milling
3. Utilization studies in the woods and in the mill and factory
4. Little used species studies
5. Wood preservation investigations
6. Forest products statistics
7. Fire behavior studies
8. Fire control planning
9. The economics of fire protection
10. Methods of cutting and natural regeneration in the white pine type
11. Growth, volume, and yield studies. Mostly in white pine but some in larch-Douglas-fir and ponderosa pine
12. Stand improvement methods in the western white and ponderosa pine types
13. Artificial regeneration on forestation. Includes nursery practice research, planting practice investigations, direct seeding investigations, and genetics studies of geographic races of ponderosa pine
14. The forest survey of the Inland Empire region.

These investigations have dealt mainly with the protection, proper management, and best use of the region's forest resources. The main and most critical problems have been attacked and some progress has been made on all fronts. Not all of the problems have been solved, however, even within the timber types and problem areas studied, and many critical problems are as yet untouched. One important problem which has been worked on but which is yet far from being solved is that of the utilization of the secondary commercial tree species. If a profitable market for all of these species, particularly those in the white pine type, existed, optimum silviculture could be practiced on all commercial forest lands, fire protection, slash disposal, and cutting regulations could be simplified and made less expensive, and many points in the critical forest situation in North Idaho alleviated. Because of limited funds we have concentrated our silvicultural work in the western white pine type and additional information is still needed here in this type. Surprisingly little is known of the regeneration and growth of the species associated with western white pine and practically no work has been done by this station in any of the other major timber types. Additional knowledge is needed on the form, growth, and yield of all the major commercial species.

Emergency funds are being used to finance what little work is being done on artificial regeneration and a start is only being made on one phase - direct seeding. Protection research is confining its efforts to fire alone, although it is obvious that a proper

program would coordinate research in fire, insect, and disease control in order to obtain a maximum of economy and efficiency in applied forest protection. Lack of knowledge of the definitely economic relation between the value of the resources being protected and the cost of protecting them a little, a lot, or perfectly, already stops the Forest Service in making sound decisions as to the degree or intensity of fire control that is economically justifiable in this region. Research in the economics of fire control constitutes a real need. In the very near future the forest inventory will be completed in the Inland Empire region and the real job, that of research in forest economics, begun. Recommendations on the forest situation in North Idaho, proposed in the forest survey report now awaiting review, bring to focus many questions in forest management, protection, utilization, and economic research on which we do not yet have the answers. This is particularly true in the field of forest economics, where studies of taxation, financial aspects of growing timber, and proper land use are needed. No work at all is being done on the relation of forest, woodland, and grassland cover to streamflow. The water conservation and use problem is an important one in this region as it contains the headwaters of the Missouri, the Yellowstone, and the Columbia River drainages.

Swell, This will please Billings. FAG

Although appropriations for range research were not allotted to this station until 1931, the Service had been confronted with range management problems since early in the century. By 1910 there were around 864 thousand cattle and horses, and over 5 million sheep in Montana. This was about 1½ million more than the

present livestock population of the state. With stock already on the national forest ranges, range management practices had to be determined largely by administrative investigations and by the application of research results developed in other grazing regions of the West. The practices evolved were necessarily more generally applicable to the high summer ranges under national forest control. The first allotment of range research funds were used, therefore, to initiate grazing management studies in the shortgrass ranges of eastern Montana. Recommended practices based on results obtained there will have a decided bearing upon the proper management of such ranges. Some outstanding results have already been obtained from the cattle and sheep experiments at the Miles City field station. The restoration of a grass cover on the several million acres of plowed and abandoned and of the overgrazed lands in the Great Plains area of eastern Montana has long been recognized as one of the most necessary and urgent rehabilitation jobs. There was and is an urgent demand for dependable data as to the best species and mixtures, and for inexpensive methods with which to guide the efforts of various public agencies and the thousand of private land owners in their efforts to restore the productivity of these range lands. This was the second line of range research work undertaken when additional funds were allotted to the station. The problems of artificial range reseeding are being studied and the recommendations proposed are being put into practice with more

than usual success.

In the relatively short time since funds and personnel have been available for range research in this region commendable progress has been made. Results of the first 5 years' records for the cattle grazing experiment at Miles City have been analyzed and the conclusions and recommendations from these data have been written up for release as a government bulletin. Previous to the preparation of this report current results of the experiment were released in press report and research note form as they were proved reliable. Results to date in the artificial range reseeding investigation are now in manuscript form for near future release as a Farmers' bulletin. Much of the information obtained has already been made available to range land owners within the state and some 300,000 acres have been reseeded to date. Under the Cooperative Western Range Survey 43 million acres of range land were examined, mapped, and the grazing information compiled. An 8,500-acre experimental area in the high summer ranges of the national forests is being developed and some minor technical studies are under way.

Though considerable progress has been made, there is yet much work to be done. More years of records are needed on the cattle grazing studies at Miles City to complete the experiment satisfactorily and the sheep experiment is only begun. More information is needed on the species, mixtures, methods, and site factors for range reseeding. Range adaptation tests for the few species studied are just now getting underway. Though a field center for grazing

management studies in the high summer ranges is being developed no funds are available for experiments in this field. There are numerous problems involved in the management of summer ranges both in eastern Montana and on forest ranges in western Montana and North Idaho. The intermediate spring-fall ranges that lie between the ranches in the valleys and the summer ranges are a vital link in the livestock industry, particularly in the western portion of the region. Hundreds of ranches are partially dependent on the welfare of forage on these key areas of spring-fall ranges. No funds are available to this station for experimental work on these ranges and knowledge badly needed is almost entirely lacking. Funds and personnel are likewise needed to develop a program of research in the field of range economics. Major readjustments away from dry farming towards more reliance on range livestock is in progress generally on an area aggregating 75 million acres of this region. There is a great need for research data to guide these adjustments so that costly mistakes in land use may be avoided. The size of the ranch home unit which will provide a satisfactory standard of living, the hazards of submarginal land ownership, better marketing practices for range livestock, and the best balance in use of the range with cropland and feeds must be carefully evaluated to guide a sound program. A detailed inventory of the location, extent, value, and present condition of the grazing resources is necessary to determine those management practices which are essential for the proper development, conservation, and use of the range lands for the social and economic welfare of the region. A range survey project should

be again initiated and carried through to completion. It will be seen from the above brief statement that we still have a long way to go in range research in this region.

As we are about to enter the fourth decade of research work in this region, it should be borne in mind that regular appropriations for research in fire, silviculture, and forest products are less now by around 30 percent than they were in 1931 when all lines of research work in the region were transferred to the station. This means that until increases are made, it will be difficult for these divisions to even carry the minimum program of work as now set up without taking on any new, even though urgent, work. Certain projects and studies started many years ago must be continued, even though carrying them on requires the bulk of the time and money in the allotment. Problem analyses are being prepared by the several divisions in order that we may select more effectively the studies or projects now necessary to meet the need with the limited funds and personnel at our command.

There follows a brief discussion of the results, accomplishments by the several divisions during 1940, and a preliminary review of the plans for 1941.

SILVICULTURE

Silvicultural research at this station, and, therefore, for this region, received very severe setbacks during 1940 through losses in personnel and financial support. These losses are doubly unfortunate as silvicultural research was already operating on a shoe-string basis. Because of inadequate financial support, research in this field has always been confined, for the most part, to the western white pine forests, the most valuable forests in the Northern Rocky Mountain region. The needs for silvicultural research in other forest types and for economic application studies in the white pine type have been repeatedly emphasized in the past. But with contraction rather than expansion occurring in our research organization it becomes increasingly difficult to meet our responsibilities and obligations in the western white pine type alone. To continue on a shoe string, each year ever wearing thinner, is indeed perilous, not to say impossible, for any well-rounded or even partially balanced research program for the region.

Attempting a balanced research program with inadequate personnel and financial support means spreading our efforts so thin that they become ineffectual. Yet we are continually forced toward this position by the very real demands for information.

We have attempted to meet these demands as best we can yet concentrate on a few lines of work. The results of silvicultural

research during the past year show that we have met with a certain degree of success in this course.

One of the outstanding contributions of the year was a report, issued as a station paper, entitled "Blister Rust Control in the Management of Western White Pine." This report, prepared in cooperation with the blister rust control organization of the Bureau of Entomology and Plant Quarantine, brings together certain basic facts on the ecology of ribes and pine and, through a consideration of these in relation to silvicultural and eradication practices, points toward the most effective and economical control of blister rust. The report is a real contribution to knowledge for solving one of our most serious regional forest problems.

This station also cooperated with the blister rust control organization in developing survey methods and standards for classifying forested areas with respect to relative need for blister rust control work. With inadequate funds available for blister rust control, it is more than ever important that these funds be spent in control which will buy the greatest returns in protection to pine. Effective placement of control efforts requires a rather thorough knowledge of the "white pine potential" of our forests; it is this which the surveys are obtaining. In developing methods and standards for these surveys our information on stocking of reproduction, largely summarized in an article published in the August issue of the Journal of Forestry, has been of considerable value, and our recently acquired information on

methods of estimating light intensity beneath forest canopies as well as our knowledge of early stand development have been especially useful.

Our knowledge of early stand development in the western white pine type has been rounded out during the past year by additional field work in the St. Joe and Clearwater regions. The new data have plugged gaps in the study, and they have again emphasized limiting characteristics of western white pine which must be observed in cutting methods if pine is to be maintained in future stands. They clearly show that, because of the relative intolerance of pine, only cutting methods which open the stand are favorable to pine. The results of this study have already proved valuable in consideration of cutting methods and in classification of cutover areas with respect to blister rust control.

Brought to completion during the past year was a study, begun three years ago, of the economic-silvicultural aspects of growing western white pine. A manuscript titled "Economic Management of Western White Pine Forests" has been prepared covering the results of the study; it has been reviewed and is now in the hands of the editors. This report brings together much of our silvicultural knowledge of the western white pine type and fits it into management practice. The study has proved its worth in evaluating present practices, in sifting out those which are practicable under present economic conditions. In this role the study has aided in orienting our research program by pointing out gaps in knowledge and indicating fields which need more

work as well as lines of work now overemphasized.

In the field of harvest cuttings, the Division of Silviculture has continued, in cooperation with the Division of Products at this station, light selection cuttings on the Deception Creek Experimental Forest. These cuttings have accomplished four results: (1) The stands treated have definitely been improved and trees which would have been lost through mortality, have been harvested; (2) the cuttings have made possible the extension of an intensive utilization road system; (3) the cuttings are a practical demonstration that light selection cuttings are economically possible in the more accessible areas of the white pine type; (4) they have stimulated a good deal of interest in this type of cutting among forest officers of the Idaho forests.

We have made progress in making our experimental forests more interesting, useful, and understandable to visitors by a published pamphlet, "What to See and Where to Find It on the Deception Creek Experimental Forest." This pamphlet highlights our various studies and management practices on the forest in nontechnical language. The manuscript for a similar booklet for the Priest River Experimental Forest has been partially completed.

Our knowledge of stand improvement practices for the western white pine type has been added to substantially. Results from two sets of plots designed to test a combination treatment of low thinning and an improvement cutting to improve species composition do not speak well for this treatment in pole stands under present economic conditions.

Not only did treatment costs far outweigh any possible benefits through improved quantity and quality of the final product, but the treatment actually caused an increase in mortality by making the treated stand subject to snow damage. On the other hand, results from a series of cleaning plots designed to test release of pine reproduction from domination by western larch give an increasingly promising outlook for this type of stand improvement work. Our studies to date lead us to believe that cleaning and pruning are for the present the most promising stand improvement measures for the white pine type.

Artificial regeneration studies have again been one of our most worthwhile lines of work in yielding usable results. Confined during the past year to direct seeding as in the two previous years, they have aroused widespread interest, not only in this region but other regions as well. Emphasis during the past year has been on the use of poisons for rodent control. The possibility of obtaining reproduction by direct seeding was demonstrated on plots sown in the fall of 1937 and the spring of 1938 with seed of western white pine, ponderosa pine, and Engelmann spruce. Seedlings in these plots have now completed their third growing season and appear to be well established. The best treatment of those studied was fall sowing with spots protected with screens during the first growing season which resulted in the presence of one or more seedlings in about 90 percent of spots three years after sowing. After demonstrating that seeding can be done, a

search for a more practical and less expensive method than screening for control of rodents on seeded areas was started. The use of poisons for this purpose was the most promising lead and accordingly two large scale tests were made in 1938 using both a thallium bait and a plaster coating containing strychnine on white pine seeds. Two years after sowing these areas were definitely successful with 82 percent survival on one area and 70 percent on the other. Total cost of sowing these areas was about 70 percent of the average cost of planting. Comparisons on sowings made in the fall of 1939 showed that stocking on an area with thallium bait on the ground and strychnine on the white pine seeds was no better than on an area where a thallium bait was the only poison used. In both cases seedlings occurred in about 70 percent of the spots. Hence it may be possible to eliminate the coating on seeds to be sown with a resulting reduction of $1.00 per acre in costs. The results of the tests with the two poisons were sufficiently promising to justify their use on an administrative scale. Accordingly two areas of 50 and 100 acres, respectively, were seeded by the Planting Office with the assistance of the station in the fall of 1940. Second-year results of sowings of western redcedar showed a high mortality as a result of the spring drought of 1940 but stocking resulting from fall sowing on the more favorable sites is still satisfactory. A preliminary test of ponderosa pine seeding in the ponderosa pine type showed remarkable success under screens with seedlings in 67 percent of the spots at the end of the first growing season where the first-year

survival of a plantation of 2-2 nursery stock on the same area was only 15 percent.

Plans for 1941

Reduction in financial support, effective mainly in personnel loss, makes it more than ever necessary to examine our silviculture research program very critically so we may concentrate our efforts to the greatest advantage. It is evident that our first task is to maintain studies already underway and our second job to complete as rapidly as possible compilation and analysis of data, and report writing for studies completed except for these phases. Our specific plans for the coming year are as follows:

(1) Make periodic remeasurements on 15 plots measuring increment and mortality of residual trees after logging, 11 plots of stand improvement tests, 2 plots measuring growth and mortality in uncut stands, and 2 miscellaneous plots, all in the western white pine type.

(2) Complete compilation and analysis of data, and report writing, for a study of early stand development.

(3) Compile and analyze data from two sets of permanent sample plots, one set testing thinning methods and another set testing cutting methods, in white pine. Prepare reports on results.

(4) Continue regeneration studies in direct seeding, testing new sites, and new methods of rodent control.

(5) Continue light selection cuttings on the Deception Creek

Experimental Forest and a program of extensive stand improvement on the Priest River Experimental Forest.

(6) Complete "show-me" material for silvicultural studies on the Priest River Forest.

(7) Cooperate with blister rust control organization in study of damage to forest reproduction by grazing in the white pine type.

FIRE RESEARCH

The two outstanding needs for new knowledge to improve the efficiency and reduce the cost of fire control in the Northern Rocky Mountain region lie first in fire danger measurement and second in the advance estimation of rate of spread of fire and rate of line construction in each of the greatly different fuel types encountered in this region. Improving the efficiency of man-power and tools for building "held line" is rated by some authorities as a third major possibility, but this admitted opportunity falls so clearly in the field of administrative efficiency in which so many men are already working intensively that it is not included here as among the functions of research permitted by existing finances.

Determination of the places at which fire danger should be measured, whether on mountain top, in valley bottom, on a side ridge, or at what distance up a slope, together with the distribution of such measurement spots to represent all variations of danger within a forest property, is THE greatest single "blind spot" in our vision today. Given such knowledge, nearly all other essential procedures are now known with sufficient accuracy to enable (1) material reductions in the cost of keeping an adequate force of men on duty, (2) in reducing damages caused by fires escaping immediate control, and (3) in reducing the costs of large-fire suppression, which are

often the major part of the total expenditure for forest protection. As will be shown, marked progress already has been made in (2) but material additional savings are still possible in both (1) and (3).

As stated, "nearly all other essential procedures are now known." One relatively minor, yet essential, need in improving fire danger measurement is for a method that can be used consistently by different individuals located at numerous widely distributed stations to determine the inflammability of the current season's growth of grasses, weeds, and shrubs.

Much effort has been devoted by our station to proper sampling of a forest property. The research done in 1940 has brought our knowledge of sampling to the next to the last step believed needed. That step, a transect of a mountain valley to determine differences in fire danger from a ridge top down a north slope into a stream bottom and up the opposing south slope to its ridge top, is to be commenced, if possible, in 1941. No work has been possible during either 1939 or 1940 on the problem of measuring the current inflammability of each important species and all mixtures of the many species of grasses, weeds, and shrubs that contribute to the fire problem in this region.

Research to obtain measurements of actual rate of spread of fire in each significantly different fuel type and under each of several classes of weather danger has long been recognized as essential to sound fire control planning, efficient dispatching of

men, and to reduced fire suppression costs. Financed by the regional office a beginning was made, by one man, in 1939. In July 1940, Paul W. Stickel, experienced in fire research in New England, was transferred to this work at our station, by sacrificing an important position in our Division of Silvicultural Research. Regional office aid is being withdrawn in January, due to lack of funds, and Stickel will now endeavor to add to the data so far accumulated. Results to date show that small fires in what is now classified as a certain rate-of-spread fuel type may be expected to spread at greatly different rates even though fuel moisture, wind, and humidity are approximately the same in all cases. Obviously, either the present concept of fuel type requires refinement or the weather factors influencing fire behavior are not yet being adequately measured, or both.

One investigation made during the 1940 fire season was devoted not to new research but to the determination of the value of past research. This investigation produced exceptionally clear evidence of (1) the improved efficiency of fire control, due in no small part to the use of previous fire research results, and (2) the economic value of that improved efficiency expressed in dollars. It is always extremely difficult to determine "what would have happened if you had not done what you did do." It is only rarely that the answer to such a question can be even approximated in terms of dollar values saved.

In early July 1940 all of the Northern Rocky Mountain region, on both sides of the International Boundary Line, was subjected to the greatest concentration of lightning fires ever experienced since fire records were commenced. Preceding weather had been similar, topography was similar, and fuel types were similar on both sides of the line. Only the fire control facilities and the number of men available were different, the Canadians having had very limited funds for such things during the past many years, while the national forests have been investing consistently in roads, lookout houses, etc., shown by fire control planning research to be essential to adequate protection.

The opportunity therefore existed to determine approximately how much the national forest developments and expenditures of the past 10 or 15 years were actually worth in reducing the great cost plus loss to which both areas were now exposed. Adjacent areas of about 5,000,000 acres consequently were chosen, separated only by the International Boundary Line. Costs and losses were determined for each of these contiguous, similar areas.

On the Canadian side, with only the barest skeleton of roads, trails, lookout stations, fire chasers, and organized man-power for combatting forest fires, some 185 new lightning fires resulted in 12 escaping early control. The Canadians spent $49,000 fighting these

fires with most of the expense caused by the big ones, some of which were still uncontrolled in late August when this comparison was made. More than 220,000 acres of forest land, several hundred acres of unharvested wheat, one logging camp, three farm barns and much wild life were burned. Over this entire area the inestimable soil and water protective effects of the forest cover were greatly damaged. At a valuation of only $1.75 per acre for the forest growth and its many benefits, and with reasonably assessed damage to the other property, the total damage was estimated at $431,000. The total Canadian cost plus loss was therefore at least $460,000.

On the contiguous 5,000,000 acres protected by the Kaniksu and Kootenai National Forests 521 new fires were fought during this same period. Not one of these fires escaped control for more than four days, and while the cost of controlling them was $197,000, only 5,826 acres were burned over. At the ridiculously low assessment of $1.75 per acre, this gave a damage of about $10,000 and a total cost plus damage of $207,000. This is $273,000 less than the total spent and lost on the Canadian side.

The application of past research devoted to fire control planning; the construction of essential roads, trails, telephone lines, lookout stations, etc., called for by the fire plans; the selection and training of an adequate and do-or-die spirited organization of fire-fighting foresters; and the exercise of all the skills of the successful fire fighter, therefore seem to have saved for the people of the

United States some $273,000 in national resources as a dividend on their previous investments in science and forest protection.

If this limited comparison is typical of the results attained on the other eight national forests in northern Idaho and western Montana, and it is believed to be fully typical, then the net saving in this one region and year was $1,850,000. Furthermore, the facilities, the organization, the knowledge, and most of all the spirit required to meet such emergencies are still available, ready to repeat again next year and every year that they may be called upon.

FOREST PRODUCTS

The Division of Forest Products was organized in December 1908 and is now in its thirty-third year. The work of the division falls into three lines, (1) timber harvesting and conversion investigations, (2) wood preservation investigations, (3) forest products statistics. Appropriations for the fiscal year 1941 amount to $12,625 compared with $13,150 in 1940. A resume of work done in 1940 appears below.

(1) Timber Harvesting and Conversion Investigations

Tests were made of the suitability of western larch for veneer and plywood. Three other agencies cooperated in the project: the Anaconda Copper Mining Company which furnished the logs; the Milwaukee Railroad which hauled them to Madison, Wisconsin; and the Forest Products Laboratory of the Forest Service which made them into veneer and plywood. The report of the Forest Products Laboratory is fairly encouraging so far as the technical properties of larch are concerned. However, the technical aspects are only one phase of the problem. Equally important are economic factors such as the source, cost, and available supplies of raw material, plant investment costs, probable markets, profit margins, etc. Studies of this order belong more logically in the field of private enterprise.

In January 1940 a paper was prepared with the title "Possibilities of Partial Cutting in Young Western White Pine." The paper was well received and the supply is now exhausted. The paper was the outgrowth of a sample cutting made in 1937 on the Kaniksu National Forest in which one fifth of the stand volume was removed in a 64-year-old

white pine stand. The object was to determine whether it was feasible to make light cuts which took only one fifth of the stand volume, and, second, what the timber was worth. Since the results were quite gratifying, the Kaniksu Forest made two small commercial sales in similar age classes and they now contemplate a sale of about 15 million feet in a 160-year-old age class. In the proposed sale about 40 percent of the white pine is to be marked for cutting and if the sale is consummated it will, to say the least, be a radical departure from customary national forest utilization and silviculture practice. On the Deception Creek Experimental Forest light cuts have already been made in 160- to 180-year age classes. In 1939 a commercial sale was made which took 25 percent of the stand volume, a similar sale was made in 1940, and a third is contemplated in 1941. Trees cut in the 1939 sale were studied in the sawmill and mention will be made of this in the next paragraph. Other data were recently gathered in the 1939 cuttings which it is hoped will shed light on the effect of light cuts upon stand development. These data will be analyzed in the near future. The above studies of light cuts in white pine are being made in cooperation with the Division of Silviculture.

In past years many utilization studies have been made whose aim is to determine the amount and kind of lumber produced by trees and logs of different sizes and qualities, and the cost of producing the lumber. The most recent one of this kind was made in 1939 at the sawmill of the Ohio Match Company, Huetter, Idaho. The timber studied came from a lightly cut stand of 160-to-180-year-old

white pine on the Deception Creek Experimental Forest. The trees marked for cutting were of low vigor, very defective, or otherwise deteriorating, and some of these were studied in the sawmill. The purpose of the sawmill study was to determine the value of such timber. The bulk of the computations were completed in 1940 and the analysis is awaiting the remanufacture of some lumber which is still seasoning in the yard of the cooperating company. It is hoped that this study can be concluded in 1941. Although no new studies of this kind were made locally in 1940, help was given in a study which was undertaken cooperatively by the Boise Payette Lumber Company, Boise, Idaho, and the Forest Service. The help amounted to the time of one man for 1 month. The object of the study was to obtain data which would show whether the company's present marking practice was correct and, second, to obtain data which would permit them to participate in Wohlenberg's "tax depletion" plan. It is reported that this study was of considerable benefit in that the cooperating company made refinements in its woods practices and is leaving its lands in more productive condition than heretofore.

A study was started to determine the relative merits of sawn and round mining timbers. At present round timbers are used extensively, and since they come from small trees the residual stand is often left in an unhealthy state. If sawn timbers were substituted they could be obtained from mature trees. This would have the twofold effect of leaving forest land in better condition and, second, promoting better utilization as with large trees the poorer material

could be sawed into mining timbers and this would raise the grade and value of boards which are intended for commercial markets. During 1940 considerable data were gathered and partially analyzed. However, it appears as though the results will be negative and there seems to be little possibility of substituting sawn material because of its much higher cost. The study will be concluded in 1941.

Another utilization question which has come to the foreground pertains to the possibilities of expanding the use of the large supplies of native species which are suitable for wood pulp and paper. Pulp logs are being shipped from Idaho to a pulp mill in Wisconsin and this has revived the question, "Why not build a pulp mill here?" Recently a few days were spent in looking into the possibilities and a brief report on the subject, now in preparation, will be completed shortly.

Among new plans for 1941 is an analysis of the utilization problems within the region. The purpose of this analysis is to direct research effort into lines where it will be most productive of results. Such studies have been made in other forest regions of the United States and they have helped greatly in organizing research effort.

(2) Wood Preservation Investigations

The objective of these wood preservation studies is to determine the durability of treated and untreated telephone poles, fenceposts, ties, and timbers cut from the native species and to determine

the efficiency of different wood preservatives and treating processes. At present (January 1, 1941) the project has 15 installations, the oldest of which is a fence built in 1909 at the National Bison Range in which western redcedar posts treated with coal-tar creosote are being tested and the most recent, a fence built in 1935 at the Squaw Creek Ranger Station on the Gallatin National Forest, in which lodgepole pine posts treated with a tetrachlorphenol-petroleum mixture, are undergoing test.

During the year inspections were made of eight different installations and progress reports were prepared or are in process of preparation. Twenty installations were being studied at the beginning of the year, but five were discontinued during 1940 and final reports prepared because the installations had served their usefulness. Of the 15 installations which remain, seven consist of telephone, telegraph, and power pole lines, five are fence and corral post installations, and the remaining three are railway cross-tie test tracks.

Approximately one fourth of the time chargeable to wood preservation projects was spent in answering inquiries which brought up such questions as how to treat wood with preservatives, how to inspect timbers in service, and what kind of material to select for specified conditions of use. There has been a particularly good demand for the publication "Instructions for Preservative Treatment of Telephone Poles, Stubs, and Fence Posts." It

will probably be necessary to issue a supplementary edition as the present supply is exhausted.

No new work is planned for 1941. However, inspections will be made of nine installations, most of which are in eastern Montana, and progress reports will be prepared for six installations which were inspected during 1940 but which had not been reported on.

(3) Forest Products Statistics

The lumber and timber products census was completed on August 10 when preliminary figures were issued. A total of 377 active operations in Idaho, Montana, and northeast Washington were canvassed, including 150 firms in South Idaho whose schedules are solicited by the Ogden office of the Forest Service and then forwarded to this station. The preliminary 1939 figure for Idaho showed a lumber cut of 677,296,000 board feet and for Montana, of 271,909,000 feet, a gain of 22 percent over the 1938 figure for Montana and 15 percent for Idaho. Wages and salaries paid by the lumber and timber products industries in 1939 amounted to $3,245,790 in Montana and $8,808,235 in Idaho, according to preliminary figures. This project is handled each year in cooperation with the Bureau of the Census.

In cooperation with the administrative organization, lumber manufacturing costs for 1939 were collected from 25 of the band mills in the region. A summary of the costs was prepared and distributed to the cooperating companies. These costs have been collected for each of the 24 years since 1916. Costs for 1940 will again be collected in the forepart of 1941.

Semiannually, six of the leading railway companies in the region supply information on railway tie specifications and prices paid for ties. The data are compiled and issued as a mimeographed circular to forest supervisors and others on the mailing list. The project has been under way since 1908 and will be continued in 1941.

The agreement was renewed with the Western Pine Association whereby the Association furnishes monthly and quarterly the wholesale selling price of lumber of different species, grades, and sizes, and quantities sold. The information obtained is compiled and used within the Forest Service for timber appraisal purposes. This year the process of compiling the information was speeded up with the net result that the quarterly price reports were issued 3 weeks earlier than the average for the past 3 years. The monthly prices which appear in the "Monthly Summary of Business Conditions" were issued on schedule.

The retail selling price of certain specified lumber items was obtained as usual. The information is obtained quarterly from 20 retail lumber yards in the region and compiled semiannually. The project has been under way since 1922 and will be continued in 1941.

Current prices paid for cedar poles, posts, and piling, which have been collected since 1923, were obtained from dealers in the several producing centers, summarized, and issued in mimeograph form to the national forests for use in timber appraisals.

The usual publications were prepared showing stumpage transactions in the Northern Rocky Mountain Region and, second, log prices.

The stumpage price tabulation was based on transactions totaling 601,026,000 feet log scale and showing a value of $2,678,531. The log price tabulation was based on transactions totaling 178,776,000 feet and a total value of $1,982,345. Data for these compilations were solicited from timber owners in cooperation with the Bureau of the Census.

With the cooperation of the railway companies and the State Forester of Montana, statistics were obtained which showed the 1939 production of Christmas trees in western Montana to be 1,967,350 trees or roughly one sixth of the national consumption. Detailed figures were published in Research Note No. 8.

The above statistical data are useful in many ways. Some are used by the Forest Service and other governmental and private agencies for timber appraisal purposes. They are also used generally by various agencies, both public and private, for a variety of purposes which are almost too numerous to mention. Within the past week, for example, figures were furnished the University of Montana on lumber production; a call came from a representative of the U. S. Department of Labor for figures on production of different forest products, wages paid, and number of men employed; two requests were for lumber prices; another request was for the price of cedar poles; another request was from a university professor who was preparing a short statistical summary of Montana's lumber industry for an encyclopedia. The information is circulated widely and probably each week there are scores of uses which never come to the direct attention of the division.

FOREST SURVEY

The year 1940 witnessed the finale of the original forest survey project in northern Idaho with the completion of the analysis phase in a report entitled "The Forest Situation in Northern Idaho." As the name implies, the report examines the forest problem from every angle. Although it has yet to pass final review, and probably will not reach the Government Printing Office until late 1941, the manuscript is already filling a long-standing need for analytical information. Some of the material contained is being used in connection with the Forest Service educational program.

It has been long recognized that the growth and drain in northern Idaho do not balance. The report indicates that the average annual cut of all species, except cedar poles, has been 580 million board feet as compared with an "allowable cut" of 518. These figures tell only part of the story, for white pine which has a sustainable cut of 140 million board feet yearly is being cut at the much faster rate of 351 million feet a year. The other species could supply a cut 149 million board feet greater than at present.

The sustainable capacity of the forests has always been restricted because of fire losses. It is estimated that the allowable cut of all species might be 20 percent greater were it not for fires. However, the fire problem, which appeared well nigh insuperable in 1910 when one-fifth of the forest burned, is gradually being met. In the period 1910-1919 an average of 277,000 acres burned over within the national forests each year. From 1930 to 1939 the annual loss was 47,000 acres.

Departing from the usual procedure of justifying white pine blister rust control because the disease threatens to eliminate the white pine industry, the forest survey has attempted to come to grips with the problem by measuring the potential loss against the cost. Because of the great noncommercial areas, which must be protected from fire, the cost of administering the national forests will probably always be greater than their cash revenues. However, by engaging in blister rust control work the net administration cost will be lowered, and in addition northern Idaho will enjoy the benefits of the white pine industry, which it otherwise would not have.

Examination of inventory statistics indicates the importance of the public as a forest land owner. Seventy-two percent of the total forest area, 61 percent of the commercial forest area, and 55 percent of the white pine timber volume, are publicly owned.

It seems inevitable that public will own a much larger percentage of the forest before the ownership picture becomes static. Recent trends have been definitely in that direction. In the 10-year interval between 1928 and 1938, the rural area on the tax rolls decreased by 518,000 acres as a consequence of donations to national forests, and tax foreclosures. This is about one-tenth of the taxable acreage in 1928. The nub of the situation is that the economic handicaps are too many for permanent operation to be an attractive proposition to the average private forest owner.

It is believed that any effort to slow the cutting on the privately owned land would be economically impractical. However, since 54 percent of the white pine sawtimber is owned by the State

of Idaho and the Federal Government in the national forests, some of the effect of overcutting on private lands can be neutralized by holding back state and national forest timber, as much as possible, in those localities which are being overcut.

During 1940 the field mapping and inventory work was completed on 2.7 million acres in Missoula and parts of Lewis & Clark and Powell Counties. This brings the total area covered in the Inland Empire region to 89.5 million acres. Approximately 2.5 million acres remain to be covered in Montana west of the Continental Divide. It should be possible to complete this area during the coming field season.

It has been decided not to extend the forest survey into eastern Montana with regular survey funds. The high proportion of nonforest land and the relatively low commercial importance of much of this timber prompted this decision. A W.P.A. project has been organized for the purpose of type mapping as much of this area as funds will permit, and to estimate those bodies of timber which are or may become commercial. Two technical foresters, in addition to clerical workers, are now working on this eastern Montana project. They are constructing forest type maps from aerial photographs supplemented by field work where necessary. In this manner, approximately 1.5 million acres were covered during the last two months of 1940.

The study to determine forest increment in North Idaho was completed and the results published in Forest Survey Release no. 18, "Forest Increment in North Idaho" by L. J. Cummings and Paul D. Kemp.

RANGE RESEARCH

It is evident that all possible efforts should now be marshalled for national defense and preparedness. However, there is grave danger that measures vital to defense in the long swing may be submerged and neglected in the haste for an immediate increase of armaments. Safeguarding our natural resources is a complex undertaking and research needed to point the way cannot be turned off and on at will like a water tap. Research in resource management requires continuity of effort for a long time to be really effective and should be considered as an essential phase of national defense quite as definitely as increasing of armaments. The recent announcement of surplus canvas truck covers and horse blankets worth two million dollars, available for transfer from the military establishment, is but one illustration of a common attitude toward research in comparison to other government activities. Some part of this large sum might well have been devoted, for example, to research needed as a guide to better management of an immense acreage of mountain and foothill ranges in the West. Wasting soil and production far below potential capacity is an enemy rather than a benefit to national security.

In the absence of adequate funds for effective work on a project basis on management of summer range at Vigilante, clipping, quadrat and utilization studies of limited scope are being made. Data from clippings for two years indicate, according to best available standards, that grazing might have started in 1938 and 1939 about a week earlier than the present

June 1 date. Quadrat and other data for 1940 have not yet been fully analyzed, but this range appears to be improving under the use and weather conditions prevalent in recent years. Utilization surveys are made each fall and means of improving and making this method are constantly being sought. A series of pastures should be set up for controlled grazing and a more adequate design and program will be established to strengthen present studies as soon as funds are available.

The 1930-39 decade went down as the driest of record at Miles City, but precipitation for 1940 was .33 inch above normal, the only year since 1932 that it has reached the normal of approximately 13 inches. Vegetal density on quadrats in cattle experimental pastures was 84 percent greater than a year earlier and further improvements apparently took place after early charting so that density of these short-grass ranges at the present moment is near the predrought level. Reasonably favorable weather for three successive seasons has done wonders for these short-grass ranges depleted by severe droughts in 1934 and 1936. This recovery, together with the conservative rate of increasing livestock numbers, the increases in reserve forage and hay, the consolidation of small land holdings into better economic units and better range control, have laid a foundation for more stable land uses and a vigorous economic recovery in eastern Montana. However, current income has been very restricted on many understocked ranches.

Important hazards must be recognized and met before this prospect of better days in the social and economic life of eastern Montana can

be fully realized. Livestock prices are now high and we are apparently well on the way toward another peak in both sheep and cattle cycles. Sharp price declines have ordinarily accompanied these peaks in livestock numbers. Another severe drought during this period of readjustment would not be unusual. This situation seems to emphasize the need for range and livestock management that will help to cushion and minimize the drought handicap. The evidence from seven years' data from Miles City clearly indicates that cattle production under heavy grazing is more expensive and involves greater risks than more conservative use of such ranges. Earlier sales of market animals and other range practices that will help to meet these hazards have been clarified and pointed out in the recent manuscript submitted for publication giving preliminary results from our cooperative management work on cattle ranges at Miles City.

During the past four seasons, yearling ewes have gained 5.7, 9.9 and 2.2 percent more in pastures K, L and M, respectively, than in J, the smallest pasture in the series which was grazed most heavily. Considering these gains at 8 cents per pound, the average yearly gains in the next larger pastures, K and L, have a value of 18.66 and 22.06 cents per ewe greater than for those in pasture J. Even though these differences have not yet been highly significant, they are at the average yearly rate of $151.92 and $264.72 for a band of 1,200 ewes.

The surprising forage recovery that has taken place since 1937 has largely canceled the full effects of increased numbers of sheep

grazed in an effort to maintain a degree of use originally planned for these sheep pastures. Otherwise, the above differences might have been more significant. Records for vegetal trends on sheep pastures since early 1939 have not yet been fully analyzed but prior to 1939 they showed no significant differences for pastures grazed at different intensities. This tends to confirm other evidence that these short-grass ranges are quite resistant to heavy use. The gains on ewes in pasture M have been erratic and have averaged only slightly higher than for J, due to special conditions there that have proved this pasture to be not strictly comparable with J, K or L. Pasture M will be dropped from the experiment in 1941 and the work will continue for one more year on the remaining three more comparable pastures.

Numerous land managing agencies and still greater numbers of landowners and managers now desire detailed information on better ways to manage their range resources. A West Coast representative of one federal agency recently spent four days going through our range data seeking definite information on a number of questions including how ranges and stockmen are effected when flood control measures require reduction in numbers of livestock. He reported a real scarcity of definite data on these points and that our information was the most helpful yet found. However, our research program is so limited on mountain and foothill ranges that we could only guess at some of the answers he needed for such areas. Land managers seeking such information

are "all dressed up with nowhere to go." They can continue to guess but can have no assurance as to what management practices are best on a tremendous acreage of wild land. The need is more clearly recognized and range land managers are more anxious than ever before to have research to point the way toward greater stability than the helter-skelter type of land exploitation that resulted in the waste of economic and human resources that has characterized several previous decades. Numerous requests for station notes giving current research results, attendance of operating stockmen at our field demonstrations, and other evidence indicates a growing demand for guidance in range management practices.

Reseeding work during the past year has been devoted largely to developing a comprehensive working plan and to range adaptation tests on three typical areas. Some assistance has been given to reseeding on the Bitterroot and Beaverhead Forests, the only ones to request such advice and guidance in reseeding. The former job is of interest because a logged and largely burned-over area of yellow pine was reseeded in a deliberate effort to change the cover in response to urgent need for forage from small dependent home units nearby. Preliminary success from several species reseeded in the spring of 1940 has been very gratifying and there is now an opportunity to determine how much assistance, if any, will have to be given the grass to permanently replace the native yellow pine on this area. Previous plans to test reseeding from the air could not be carried out.

A nearly pure stand of crested wheatgrass at the U. S. Range Livestock Experiment Station carried yearling steers and heifers from May 8 to September 25 with net average gains of 1.6 pounds per day for the 140-day period. The crested wheatgrass was harsh and dormant during the midsummer period when weight losses occurred, but these quickly changed to gains at the rate of 2 pounds per day immediately after late July rains amounting to about 1½ inches caused the grass to green up noticeably. The crested wheatgrass supported the yearlings at the rate of approximately .8 acre per head per month, while yearlings grazed on a nearby native range pasture required approximately 2 acres per month. The native range pasture had not, however, fully recovered from effects of drought and past misuse.

The improvement of range research methods is a basic need for cheaper and better progress in this field. Some limited progress has been made in improving the procedure in utilization surveys for both short-grass and bunchgrass ranges at Miles City and Vigilante. After providing for necessary work on going projects not sufficient time is available to devote to the improvement of range research methods that its importance justifies.

Major changes are not contemplated in the range research program for the coming year but the adjustments mentioned below will be made. Yearling ewes seem assured for one more year of field work on this phase and an agreement has been reached to change from the very

troublesome one-bull plan in our cattle project at Miles City back to the plan of using six bulls. It would be highly desirable if the program at Vigilante could be expanded to a more comprehensive project basis and if a more definite program of work in the field of range economics could be started.

A local committee of Bitterroot Valley (Ravalli County) residents are working on a program to improve land use and management in the valley. Supervisor Brandborg is actively interested in this because lands inside as well as outside his forest are involved and the social and economic situation is acutely in need of betterment. There is no county agent in this county and the supervisor has requested assistance of the station in making plans for better range management and for the reseeding of depleted and cheatgrass infested ranges. It is planned to arrange our work on cheap methods, adaptation of species and mixtures and to provide assistance to the full extent possible in range phases of this Ravalli County program.

A manuscript giving preliminary conclusions from management work at Miles City, of particular value to minimize drought handicaps, has been submitted to a board of review for publication as a technical bulletin. A manuscript for a farmers' bulletin on artificial revegetation will soon be completed for submission. Briefer articles on certain phases of our work will be written for publication in trade and scientific journals.

January 1940

HARVEST CUTTINGS - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Harvest Cuttings (western white pine type)

PURPOSE OF WORK: To develop methods of cutting through investigation of controlling factors that will result in adequate natural regeneration of desired species.

REVIEW OF PAST WORK: Much of the station's silvicultural program since its beginning has centered around methods of cutting and natural regeneration. Various studies of cutting methods, seed supply, seed germination, initial survival, establishment, and early development have been made and reported upon from time to time in numerous publications and station manuscripts. The results of most of these studies have been brought together in comprehensive fashion in "Natural Regeneration in the Western White Pine Type," in process of publication as U. S. Department Agriculture technical bulletin no. 767. With the completion of this manuscript, several of these studies have been closed and the way cleared for new studies. Valuable in evaluating further research needs in this field is a study of the economics of managing western white pine forests, built around the North Fork of the Coeur d'Alene River as a case unit, of which field work was completed in 1938 and analysis completed and report prepared in 1939. Of new work, in addition to the economic study, greatest emphasis has been placed on studies of stand development during the early and formative years. In cooperation with other agencies, a preliminary study of root diseases in western white pine has been completed and a report of results issued as station paper number 1. In cooperation with the Division of Products at this station, a light selection cutting to remove dead, dying, and poor vigor trees was carried out in the Deception Creek Experimental Forest during 1939, providing information on the possibility of light cuttings in the white pine type.

PROJECT STATUS SHEETS

ACCOMPLISHMENTS DURING PAST YEAR: 1. Report on economic management of western white pine forests rewritten, reviewed, revised, and sent to the editor.

2. "Show-Me" mimeographed booklet prepared for Deception Creek Experimental Forest and a similar booklet for the Priest River Forest partially completed.

3. Paper on measures of stocking in natural reproduction stands prepared and published in Journal of Forestry for August.

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4. Field work for study of early stand development in St. Joe and Clearwater Forests completed, rounding out field work for this study.

5. Cooperated with blister rust control organization in preparing a report on blister rust control in the management of western white pine, issued as station paper number 3. Also assisted this organization in developing survey methods for classifying cutover areas with respect to need for blister rust control work.

6. Continued light selection cuttings on the Deception Creek Experimental Forest as a cooperative study to obtain information on their possibilities in white pine forests and to provide a practical demonstration of such cuttings.

PLANS FOR 1941:

1. Complete "show-me" booklet for Priest River Forest.

2. Compile and analyze all available data of early stand development and prepare a station paper on the subject. Complete two papers on special phases of this subject.

3. Cooperate, to our ability, with the blister rust control organization in their study of effect of grazing on ribes and pine reproduction.

4. Continue light selection cuttings on the Deception Creek Experimental Forest.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner.

STAND IMPROVEMENT - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand Improvement (western white pine type)

PURPOSE OF WORK: To develop cultural measures which will improve the quality and growth of immature stands.

REVIEW OF PAST WORK: Studies of intermediate cuttings were begun in 1914 with the establishment of a series of thinning plots. Work was continued in a more or less desultory fashion until 1933 when, with the establishment of the Deception Creek Experimental Forest and availability of emergency funds, a moderate program of stand improvement was undertaken. Fairly extensive work was also done by the administrative organization. In 1936 available information on stand improvement practices was assembled in a mimeographed manual, "Stand Improvement Practice in the Western White Pine Type," accepted by Administration as standard instructions for this class of work.

In 1938, in cooperation with Region One, a rather comprehensive summary of stand improvement work done in both western white pine and ponderosa pine was made. All information available, plus additional silvicultural data obtained in the field, was systematically assembled in unit reports and a brief summary of results was prepared.

Periodic remeasurements are made on the following: 20 permanent plots in young stands of less than pole size, 39 permanent plots in pole-sized stands (one of these is the subplot latin square), four girdling plots, and eight small pruning plots. Results to date indicate that cleanings to release white pine and pruning of young white pine are the two stand improvement measures offering the most promise at the present time.

Extensive thinnings in replicated strips, mainly to release western redcedar, made in the Priest River Experimental Forest. Extensive cleaning to free white pine from larch in replicated strips established within Deception Creek Experimental Forest.

ACCOMPLISHMENTS DURING PAST YEAR: (1) Continued extension work with administrative organization to check applicability of present methods and to suggest improvements in technique. (2) Prepared progress reports on two sets of thinning plots, testing combined low thinnings and improvement cuttings in pole stands of the white pine type. Although treatment on

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both sets of plots resulted in accelerated growth rate on selected crop trees, it also increased mortality by snow breakage. Benefits are far outweighed also by treatment costs. The results are not at all encouraging for intermediate cuttings in pole stands at the present time. Rough draft of report summarizing results prepared to be released as a station research note. (3) Remeasured 13 cleaning and 6 permanent thinning plots. (4) Continued extensive stand improvement work consisting of thinning and pruning on the Priest River Experimental Forest. (5) Established three small plots to determine amount of crown to remove in pruning.

PLANS FOR 1941: (1) Continue extension work with administrative organization. (2) Prepare two station research notes on effect of thinning. (3) Reexamine 13 small pruning plots. (4) Continue extensive stand improvement work on the Priest River Experimental Forest.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner.

STAND IMPROVEMENT - PONDEROSA PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand Improvement (ponderosa pine type)

PURPOSE OF WORK: To develop cultural measures which will improve the quality and growth of immature stands.

REVIEW OF PAST WORK: 1. Twelve plots to test different weights of thinning established on the Lolo National Forest during 1933 in a 50-year-old ponderosa pine stand. Fifth-year remeasurement of these plots showed that ponderosa pine responds well to thinning. Greatest response was obtained in heavily thinned plots. Results shown by fifth-year remeasurement, summarized and issued as station research note number 3.

2. Three additional thinning plots established on the Lolo National Forest in a 30-year-old stand during 1935.

3. Extensive test of pruning ponderosa pine made on more than 300 acres in the Priest River Experimental Forest.

ACCOMPLISHMENTS DURING PAST YEAR: 1. The three 1935 Lolo thinning plots were remeasured and data partially compiled. 2. A small plot to determine the relationship between pruning and subsequent infection was established on the Priest River Experimental Forest.

PLANS FOR 1941: Preparation of a progress report, to be issued as a station research note, on the fifth-year remeasurement of the three Lolo plots.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

January 1941

STAND STUDIES - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (western white pine type)

PURPOSE OF WORK: To determine composition, growth, yield, and mortality in western white pine stands.

REVIEW OF PAST WORK: 1. Type-wide study of growth and yield in fully stocked natural stands. (Published as U.S. Department Agriculture technical bulletin 323.)

2. Establishment and periodic remeasurement of 34 permanent and 54 semipermanent yield plots in natural stands.

3. Increment and mortality observations of the residual stand on 24 permanent plots in cutover, mature, and overmature stands. Ten-year records available for nine of these plots showed a consistent loss of the residual stand in net volume amounting to 20 percent the first decade, substantiating the observation that old white pine stands have a tendency to deteriorate following a partial cutting.

4. Type-wide study of increment and mortality in cutover stands using temporary plot technique. Field work done in 1928, 1937, and completed in 1938. Compilation of data completed. Project now ready for final analysis and report writing.

ACCOMPLISHMENTS DURING PAST YEAR: Remeasurement of 5 permanent yield plots in natural stands and 2 plots in cut-over stands; data not compiled or analyzed. Semipermanent plots changed from a 5-year to a 10-year remeasurement schedule, thus lightening the remeasurement load of these plots.

PLANS FOR 1941: 1. Remeasurement of 4 permanent yield plots in natural stands and 14 permanent plots in cutover stands.
2. As time permits, analysis of data from all increment studies of cutover stands.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

STAND STUDIES - PONDEROSA PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (ponderosa pine type)

PURPOSE OF WORK: To determine composition, growth, yield, and mortality of stands of the ponderosa pine type.

REVIEW OF PAST WORK: A total of 186 temporary yield plots established in even-aged stand during the period 1932-34 as part of an interregional growth study. Data turned over to the Pacific Northwest Station which prepared technical bulletin no. 630, "Yield of Even-Aged Stands of Ponderosa Pine" in 1938. About 110 of temporary plots selected for remeasurement as semipermanent yield plots. Six permanent yield plots in Lolo National Forest measured periodically.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1941: None.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

STAND STUDIES - LARCH-DOUGLAS FIR

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (western larch-Douglas-fir type)

PURPOSE OF WORK: To determine composition, growth, yield, and mortality of stands of the western larch-Douglas-fir type.

REVIEW OF PAST WORK: 1. Measurement of increment and mortality 25-35 years after cutting on 86 temporary plots in selectively cut stands. Most of office compilations made and preliminary report prepared. Final report for publication yet to be prepared.

2. Four permanent yield plots established during last 25 years in fully stocked natural stands.

3. Yield study of even-aged stands made by forest survey taking data on 150 temporary plots. Of these 42 have been selected for remeasurement as semipermanent yield plots.

ACCOMPLISHMENTS DURING PAST YEAR: Two permanent yield plots remeasured.

PLANS FOR 1941: Remeasurement of two permanent yield plots.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

PLANTING

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting

PURPOSE OF WORK: To develop methods of artificial regeneration which are economically and silviculturally satisfactory.

REVIEW OF PAST WORK: Investigative work in planting and nursery practice started with the establishment of the Priest River Station in 1911 and continued intermittently until 1926. Nursery studies in seedbed densities, season of sowing, and root pruning reported in numerous publications have contributed much to the development of nursery practice. Studies in direct seeding conducted between 1915 and 1921 did not develop a successful method. Results of planting investigations contributed to the development of a successful planting technique and indicated that season of planting had no appreciable effect on survival and that transplant stock was better than seedling stock. An analysis of plantation survival records, 1910-1936, inclusive, showed that spring-planted stock survived better than fall-planted stock and that average survival 10 years after planting was only 42 percent. To determine where improvements in planting practice might be made, investigations were resumed in 1936. A 5-year study of grade and age, class of stock, carefulness in planting and handling stock, and early, middle, and late spring planting was started, with the station and the regional planting office cooperating, and has been continued by the planting office with occasional help and advice from the station. Since 1937 the station has concentrated its efforts on direct seeding. Plots installed in the fall of 1937 and the spring of 1938 show that western white pine, ponderosa pine, and Engelmann spruce can be successfully seeded if protected from rodents during the first year. Spot sowing of western white pine using poisons for rodent control on two broadcast-burned areas resulted in a stocking of 70 and 82 percent, respectively, after 2 years. Western redcedar plots, sown without protection from rodents, were well stocked on favorable sites at the end of the first growing season. The Priest River Arboretum, developed in 1931-39, has 45 species in blocks of 1/4 to 1 acre each.

ACCOMPLISHMENTS DURING PAST YEAR: Continued observations on old and new direct seeding plots led to the following results:

1. Second-year mortality on direct seeding plots was small except in plots sown with western redcedar. 2. A ponderosa pine seeding plot on a site where planting had failed twice showed 68 percent stocking in spots protected with screens at the end of the first growing season.

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3. Broadcast sowing of Douglas-fir and white pine was more expensive and produced a lesser degree of stocking than spot sowing, although both were satisfactory. 4. Stocking on a prepoisoned seeded area was equal to that obtained on an area where both prepoisoning and a poison coating on white pine seed was used. 5. Seedlings on two western redcedar plots germinated well but did not survive the spring drought.

A seed storage study was started to determine if storage conditions at the Savenac Nursery could be improved. Average moisture content of seed in storage at Savenac Nursery was 8 percent, with a maximum of 13 percent, and is not believed to be high enough to cause appreciable loss of viability in storage. Temperature in the storage cellar varied from 58° F. in August to 30° F. in December. The storage study was set up to determine if a constant temperature of 40° F. is better for maintaining viability of seed in storage over a 5-year period than the fluctuating temperature of the storage cellar. Comparisons of seed in sealed and unsealed containers in the storage cellar will also be made.

PLANS FOR 1941: 1. Test possibility of direct seeding (a) on brush-covered ponderosa pine sites with poisons for rodent control; (b) Engelmann spruce without protection from rodents; (c) western redcedar under a hemlock overstory and under a dense brush cover; (d) white pine on a nonreproducing logged area. 2. Determine degree of success on two areas of 50 and 100 acres, respectively, seeded under the supervision of the planting office with the help of the experiment station in the fall of 1940. 3. Continue seed storage study on temperature effects. 4. Assist planting office in analysis of results on 5-year planting study. 5. Write paper on direct seeding studies to date for publication.

DATE OF COMPLETION: Continuing project. Station studies contingent on temporary funds.

ASSIGNMENT: C. S. Schopmeyer.

PHENOLOGY

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics (phenology)

PURPOSE OF WORK: To determine seasonal vegetative events of principal trees and shrubs in Region One.

REVIEW OF PAST WORK: Project started in 1928 with phenological observations made by rangers on 18 national forests, at Savenac Nursery, Priest River Experimental Forest, Yellowstone, and Glacier National Parks. Observations dropped on 12 forests between 1932 and 1934. At the beginning of 1937 observations were being made at only nine stations. Project terminated in 1937 because the station found it impossible to give adequate technical supervision. Although a large mass of information has been collected, its usefulness is greatly limited by lack of uniformity and thoroughness in making observations. Compilation of the data and preparation of a report summarizing useful information remains to be done.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1941: None. Pressure of other work will not permit the making of a final report.

DATE OF COMPLETION: Project terminated except for preparation of final report.

ASSIGNMENT: C. A. Wellner

January 1941

GEOGRAPHIC STRAINS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Genetics

LINE PROJECT: Racial variation (geographic strains of ponderosa pine)

PURPOSE OF WORK: To determine suitability of ponderosa pine seed from different sources for planting in northern Idaho; to ascertain heritable characteristics of growth, form and hardiness developed through adjustment of parents to local climate.

REVIEW OF PAST WORK: Trees grown from seed of ponderosa pine collected in 21 widely separated localities in western United States were planted in plots at the Priest River Experimental Forest from 1911 to 1917. Plots studied and reported upon by Kempff in 1927. Thorough field examination and measurements made in fall of 1935 and analysis made by Weidman. Differences with respect to number of needles to the fascicle, length of needles, general appearance of foliage, and thickening of hypoderm found among progeny groups derived from different regions delimited on the basis of precipitation type. Persistence of needles found not to be hereditary. Pronounced differences found among different progenies in height growth, diameter growth, relation of two, and relative height growth by years. Best growth in height and diameter made by trees derived from localities which in climate resemble locality of planting site. As sources of seed for planting in northern Idaho, experiment indicates trees of North Pacific region unsuitable because of low frost resistance, those of Black Hills and southeastern Montana questionably suitable because of early decline in growth rate, those of Central and South Plateaus and Colorado decidedly unsuitable because of distinctly poor rate of growth. Findings to date indicate most suitable general territory in which to collect ponderosa pine seed for northern Idaho use extends from Colville locality in Washington eastward a little beyond Continental Divide and from Salmon River to Canadian boundary. Manuscript "Evidences of Racial Influence in a 25-Year Test of Ponderosa Pine" by R. H. Weidman submitted in September 1937 for publication in Journal of Agricultural Research.

ACCOMPLISHMENTS DURING PAST YEAR: 1. Manuscript described above was published in the Journal of Agricultural Research, vol. 59, no. 12. 2. Progeny plots remeasured for survival, diameters, and heights.

PLANS FOR 1941: None.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

BEHAVIOR OF FIRES

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Behavior. Daily and Seasonal Variables.

PURPOSE OF WORK: To determine the relation between meteorological elements and inflammability of the fuels of forest fires, including the factors of inflammability and how each may best be measured. Involves (1) what to measure; (2) how to measure; (3) where to measure; (4) when to measure; and (5) how to integrate these measurements into a practical scale of inflammability and fire danger.

REVIEW OF PAST WORK: Started in 1922. Five most essential factors selected. Three new instruments invented. Integrating meter developed through five models in 10 years. Two major bulletins and several articles published describing methods.

Four seasons' work on one factor, vegetative inflammability, not conclusive. Five seasons on where to measure by Altitude and Aspect have uncovered some unsuspected and much usable information.

ACCOMPLISHMENTS DURING PAST YEAR: Principles of Altitude and Aspect tested on three other widely separated sites and found applicable. Results written, edited, and now in type as U.S.D.A. circular no. 591. Article published on vegetative inflammability. Area of doubtful value of fire danger measurements examined by regional forester, fire chief, and fire research division chief with agreement that special methods must be developed for such areas some day.

PLANS FOR 1941: If area can be cleared and if available instruments are adequate, commence last phase of where to measure by installing transect of mountain valley. If not, transfer Hayes to aid Stickel on Rate of Spread and Resistance to Control phase of Control project. Discontinue old danger meter and substitute separate fire behavior index and fire control organization meters.

DATE OF COMPLETION: Unknown.

ASSIGNMENT: H. T. Gisborne.
G. L. Hayes on Altitude and Aspect phase.

PRESUPPRESSION, DETECTION, SUPPRESSION

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Control. Fire control planning.

PURPOSE OF WORK: To determine the principles, methods, and procedures that will furnish adequate man-power and facilities for fire control at least cost in accordance with local values at stake, occurrence of fires, and fuel types.

REVIEW OF PAST WORK: Started in 1931 and prosecuted intensively through 1935, largely financed by regional office. Hornby's "Fire Control Planning in the Northern Rocky Mountain Region," "Hornby's Principles of Fire Control Planning," and several articles describe results. Based on fuel type and rate of occurrence, and omitting values at stake, specific procedures were developed to show what facilities and man-power are essential for different degrees of danger if the policy of "control by 10 a.m." is to be met. Satisfactory specification of each of the several significantly different fuel types was a major difficulty. Photographic illustrations were issued in 1936 and helped materially. Experience in 1936, 1937, and 1938 corroborated Hornby's opinion expressed in 1935 that measurements of actual rates of spread, actual weather at the fire, and detailed descriptions of the fuels being burned are essential to the refinement of fuel type classification for satisfactory planning, dispatching, and suppression. Beginning July 1, 1938, the regional office financed these essential studies, assigned C. K. Lyman to the work, and 74 actual fires have now been measured, representing three of the four rate-of-spread types and five of the seven classes of danger. Measurements of resistance to control, or rate of line construction through different fuel types also were made for 51 cases. In addition, data from 1,032 fire reports containing sufficiently complete information and representing fires in all four fuel types, were analyzed.

ACCOMPLISHMENTS DURING PAST YEAR: Lyman prepared a detailed progress report summarizing his measurements and including his recommendations as to how such measurements could and should be made to produce the desired information. In July 1940 Paul W. Stickel was transferred to this work and on two large fires Lyman and Stickel made many measurements.

PLANS FOR 1941: As funds for field assistants are completely lacking, Stickel will have to work alone as Lyman has done for the past 2 years, picking up help from fire fighters or CCC's when possible. This is very inefficient procedure and it may be decided to drop the extremely basic and valuable work Hayes has been doing and transfer him to aid Stickel.

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DATE OF COMPLETION: Rate of Spread and Resistance phase will depend upon degree of refinement of fuel type classes deemed administratively adequate for (1) planning purposes, (2) dispatching practices controlling strength of attack, and (3) future variations in suppression tactics.

Continued demand from all parts of the world for copies of Hornby's progress report no. 1, the 500 copies of which were exhausted in 1939, together with many improvements in planning technics made since 1936, justify a major publication within the next few years, probably by Gisborne for research and Sutliff or an equally experienced alternate for administration.

ASSIGNMENT: H. T. Gisborne, general supervision.
P. W. Stickel for Rate of Spread and Resistance to Control phase.

LOGGING AND MILLING INVESTIGATIONS

FIELD DIVISION: Forest Products

WORK PROJECT: Timber Harvesting and Conversion Investigations

LINE PROJECT: Logging and Milling

PURPOSE OF WORK: The work divides into three parts: (1) Combination woods-and-mill studies which provide information on the quantity, grade, and value of lumber produced by trees of different sizes and grades, the cost of producing the lumber, and the size and grade of tree which it is profitable to utilize. (2) Woods studies which provide information on logging outputs and utilization. (3) Sawmill and manufacturing-plant studies which supply information on overrun, grades of lumber produced by logs of different sizes and grades, the cost of sawing, the efficiency of various plant machinery, the waste occurring in manufacture, etc.

REVIEW OF PAST WORK: Publications now available show diameter cutting limits and other information necessary to selective logging in the (1) western white pine type, (2) ponderosa pine type, and (3) larch-Douglas-fir type. Log and tree grades have been developed locally to facilitate application of the principles deduced from the studies. Also, numerous logging output and "residual wood left after logging" studies have been made in important forest types. In the sawmill, studies conducted during the past 15 years have made available information on the average overrun of lumber over log scale for all commercial species, quantitative and qualitative waste, and the volume and value losses in fire-damaged timber, river-driven logs, and logs transported over gravity chutes.

ACCOMPLISHMENTS DURING PAST YEAR: Light Cuts in White Pine. Light cuts were continued on the Deception Creek Experimental Forest in 1940 and plans were made for further such cuts in 1941. Information was gathered in the 1939 cuttings regarding mortality and the effects of logging. Some of the timber cut in 1939 was studied in the sawmill to determine the grades of lumber which it yielded. Since the lumber is still drying, the study has not been completed. Otherwise, computations are complete up to date. Similar light cuts were made in 1937 in 64-year-old white pine, and a publication telling about the possibilities of partial cuts in young white pine stands was distributed in 1940. Operators became interested and as a result the Kaniksu National Forest made commercial sales in which the stands were cut over lightly.

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Square versus round mining timbers. A study was started to determine the relative merits of round and square mining timbers. At present round timbers are used extensively, and since many come from small trees the residual stand is often left in poor shape. Substitution of square timbers will tend to lessen the evil. Data were collected and are partially analyzed.

PLANS FOR 1941: (1) Continue study of light cuts in western white pine. (2) Complete investigation of merits of sawn versus round mining timbers.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: E. F. Rapraeger.

PROPERTIES AND USES OF MINOR SPECIES AND PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Timber Harvesting and Conversion Investigations

LINE PROJECT: Properties and uses of the little-used species and the properties and uses of products other than lumber.

PURPOSE OF WORK: To provide information on the available supply, quality, and suitability for specific uses of the little-used species (western larch, Douglas-fir, Engelmann spruce, lodgepole pine, western redcedar) and the properties and uses of forest products other than lumber.

REVIEW OF PAST WORK: Departmental bulletins have been published on western larch and white fir, respectively, and a pamphlet was distributed which dealt with the utilization of Montana forests for Christmas trees. Prior to 1933 about half the work necessary for a bulletin on lodgepole pine had been done when the urgency of other work compelled temporary suspension of activity.

ACCOMPLISHMENTS DURING PAST YEAR: Tests were made of the suitability of western larch for plywood. Cooperators were the Anaconda Copper Mining Company, the Milwaukee Railroad, and the Forest Products Laboratory. A start was made on a study which will deal with the possibilities of establishing pulp mills in Montana.

PLANS FOR 1941: (1) Complete report on wood pulp possibilities. (2) If time permits, prepare article on lodgepole pine for trade journal publication.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. N. Whitney,
E. F. Rapraeger.

DURABILITY OF WOOD - TREATED AND UNTREATED

FIELD DIVISION: Forest Products

WORK PROJECT: Wood Preservation Investigations

LINE PROJECT: Service Test Records

PURPOSE OF WORK: To provide information on: (1) the durability of treated and untreated telephone poles, fenceposts, ties, and other timbers produced from timber trees native to the Northern Rocky Mountain region; and (2) the comparative value of various wood preservatives and treating processes.

REVIEW OF PAST WORK: Periodic examinations of wood used in various forms have been made since 1910 on about 40 installations, which include telephone and power pole lines, fenceposts, mine timbers, and ties. A handbook telling how to treat wood with preservatives was distributed in 1939.

ACCOMPLISHMENTS DURING PAST YEAR: At the beginning of the year the project had 20 installations but five were discontinued and final reports on them prepared. Inspections were made of eight installations and reports prepared.

PLANS FOR 1941: Inspect the following installations: Four telephone lines, three railway-tie test tracks, and two fencepost tests. Prepare reports bringing results of all previous inspections up to date. In addition, two or three manuscripts presenting results of tests on ties, fenceposts, and poles will be prepared.

DATE OF COMPLETION: Irregular intervals when no longer useful.

ASSIGNMENT: C. N. Whitney

MANUFACTURING COST STATISTICS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Manufacturing Cost Statistics - logs and lumber.

PURPOSE OF WORK: To obtain detailed logging and lumber manufacturing costs from the larger lumber companies in western Montana, northern Idaho, and eastern Washington by personal contact. The information is confidential and is used in appraising national forest timber and in logging and milling studies.

REVIEW OF PAST WORK: Detailed lumber production costs are now available from 1916 to 1939, inclusive. This is probably the most complete series available in the United States.

ACCOMPLISHMENTS DURING PAST YEAR: Costs for 1939 were obtained as usual from 25 of the bandmills in the region. These mills have about 80 percent of the region's sawmill capacity.

PLANS FOR 1941: Obtain the costs for 1940 and continue the project.

DATE OF COMPLETION: Continuing indefinitely.

ASSIGNMENT: P. Neff, regional logging engineer - field work. E. F. Rapraeger - field work. Marie Bouchard - office compilation.

PRODUCTION STATISTICS - LUMBER AND OTHER PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Production Statistics

PURPOSE OF WORK: (1) To obtain statistics showing the production of lumber and other timber products in Montana, Idaho, and northeastern Washington in cooperation with the Bureau of the Census, Department of Commerce. (2) Obtain statistics showing the production of Christmas trees in western Montana.

REVIEW OF PAST WORK: As a result of work done by this station in the past, lumber production data from 1906 to the present time have been made available to the public. Figures on the production of Christmas trees are available from 1937 to date.

ACCOMPLISHMENTS DURING PAST YEAR: The lumber census was completed on August 10 when preliminary figures were issued. A total of 577 active concerns were canvassed, including 150 firms in south Idaho.

A pamphlet was issued entitled "Highlights of the Lumber Industry" which was based partly on forest products statistics collected by the division. Figures on Christmas tree production were obtained as usual. The number cut in western Montana in 1939 was 1,967,350 trees.

PLANS FOR 1941: Continue the project.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. N. Whitney, lumber census
Marie Bouchard, lumber census
E. F. Rapraeger, Christmas trees.

SELLING VALUE STATISTICS - LUMBER AND OTHER PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Selling Price Statistics

PURPOSE OF WORK: To collect and present in usable form lumber and timber products price statistics for eastern Washington, northern Idaho, and Montana in sufficient volume to indicate periodic trends in selling price of lumber (wholesale and retail), stumpage, logs, cedar products, and ties. These data are used in appraising the stumpage value of timber sold from Forest Service lands and for other purposes.

REVIEW OF PAST WORK: Publications now available show (1) stumpage prices by species for each year since 1912; (2) average annual wholesale lumber selling prices for each year since 1913 for the commercially important species of the Inland Empire; and (3) log prices since 1938. In addition, unpublished records are available which show the selling price of (1) sawlogs, 1912 to 1937; (2) cedar posts and poles, 1923 to date; (3) railway ties, 1920 to date; and (4) retail lumber, 1922 to date.

ACCOMPLISHMENTS DURING PAST YEAR: Each of the six price series were kept up to date. The two publications showing wholesale lumber selling prices and stumpage prices were revised to include 1939 figures, and, in addition, an article pertaining to 1939 log prices was distributed.

PLANS FOR 1941: Continue the various compilations.

DATE OF COMPLETION: Continuing indefinitely.

ASSIGNMENT: E. F. Rapraeger, stumpage and log prices
Marie Bouchard, all others.

INVENTORY PHASE OF FOREST SURVEY

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 1. Inventory Phase of Forest Survey in the Northern Rocky Mountain Region.

PURPOSE OF WORK: A comprehensive inventory of the forests of this region as part of the forest survey of the Nation.

REVIEW OF PAST WORK: Field work on this project was started in 1932. Prior to January 1, 1940, 26.8 million acres of forest and other land had been covered by the field survey. The distribution of this accomplishment by calendar years is tabulated below.

Year	M acres	Year	M acres
1932	511	1936	637
1933	955	1937	3,430
1934	10,109	1938	2,160
1935	7,478	1939	1,502
		Total	26,782

Two-inch-to-the-mile township type maps had been prepared on 22¼ million acres, and 1-inch-to-the-mile unit type maps on 21 million acres of this area.

ACCOMPLISHMENTS DURING PAST YEAR: Field mapping was completed on 2,711,000 acres in Missoula, Powell, and Lewis and Clark Counties, Montana, making a total of 29,493,000 acres. This completes Missoula County and the portion of Lewis and Clark County west of the Continental Divide. Two-inch-to-the-mile township type maps and 1-inch-to-the-mile unit type maps were completed on 4.8 million and 4.9 million acres, respectively. Compilation of field data was completed and summary tables made for Lincoln, Sanders, Mineral, and Ravalli Counties.

A W.P.A. field project was organized to obtain forest inventory information in Fergus, Judith Basin, Chouteau, Cascade, and Teton Counties, and the portion of Lewis and Clark County east of the Continental Divide. Field work, making full use of aerial photographs, was undertaken in mid-November and by the end of the year approximately 1.5 million acres (gross) had been mapped by use of aerial photographs supplemented by such field travel as was necessary.

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PLANS FOR 1941: Next field season should suffice for completing the field coverage for the area in Montana west of the Continental Divide. Field progress east of the Divide will depend upon the continuance of W.P.A. funds. During the coming year the compilation should be completed for Flathead, Lake, and Missoula Counties, and the portion of Lewis & Clark County lying west of the Divide. Two-inch-to-the-mile maps should be completed for Missoula, Lewis & Clark, and most of Powell Counties and 1-inch-to-the-mile maps for at least a portion of this area.

DATE OF COMPLETION: The Inland Empire region should be completed during 1942. The completion date of the inventory work in eastern Montana is indefinite.

ASSIGNMENT: R. K. Winters, P. D. Kemp, W. L. Royer, J. M. Honeywell, H. B. Hawk, O. B. Johnson, C. W. Brown, R. L. Conn, M. E. Metcalf, H. J. Pissot, D. L. Axlund, and J. B. LaCasse.

GROWTH PHASE OF THE FOREST SURVEY

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 2. Growth and Yield. Growth Phase of the Forest Survey in the Northern Rocky Mountain Region.

PURPOSE OF WORK: To determine the present annual board foot and cubic foot volume growth for important forest types, age classes, degrees of stocking, principal species, and other classifications, and to estimate potential annual growth.

REVIEW OF PAST WORK: Construction of larch-Douglas-fir normal yield table and a cubic-foot volume table for western larch has been completed. Field studies were made to determine the stocking of average stands of the principal forest types in northeastern Washington, northern Idaho, and western Montana in relation to the stocking of normal stands of the same types. Correction factors applicable to normal yield table current growth figures to obtain growth for stands of varying degrees of understocking were worked out for the major forest types in northeastern Washington, northern Idaho, and western Montana. Completed current annual growth calculation for northeastern Washington and northern Idaho. Prepared a rough draft of a Survey release on the forest increment in northern Idaho. Completed field work and office work on a study of cedar-pole increment.

ACCOMPLISHMENTS DURING PAST YEAR: Completed the revision and publication of growth report for northern Idaho. Calculated the current annual growth for Lincoln, Sanders, Mineral, and Ravalli Counties, Montana.

PLANS FOR 1941: Calculate the current annual growth for Flathead, Lake, and Missoula Counties in the order named.

DATE OF COMPLETION: On the basis of carrying the growth phase of the survey only over the Inland Empire portion of the region, this work should be completed during 1942.

ASSIGNMENT: P. D. Kemp.

A STUDY OF FOREST DEPLETION FROM ALL CAUSES

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 3. Depletion. A study of forest depletion from all causes in the Northern Rocky Mountain region.

PURPOSE OF WORK: To determine as part of the Nation-wide forest survey the average annual forest depletion from cutting, fire, insects, and disease within the region.

REVIEW OF PAST WORK: Data on average annual cutting depletion for the period 1925-1934 or thereabouts were collected, compiled, and published for the entire region. Supplemental compilations of lumber depletion were made for the years 1935, 1936, 1937, and 1938. Data on average annual fire depletion for northern Idaho compiled and also for three counties in northeastern Washington, and for Lincoln and Sanders Counties, Montana. Determination of epidemic insect and disease depletion in northern Idaho completed.

ACCOMPLISHMENTS DURING PAST YEAR: Collected recent fire and logging records for Flathead, Mineral, Ravalli, and Lake Counties, Montana.

PLANS FOR 1941: Calculate the depletion resulting from fire, insects, and disease in Missoula, Powell, Granite Counties, and portions of Deerlodge, Silver Bow, and Lewis and Clark Counties.

DATE OF COMPLETION: On the basis of carrying the survey project only to the Continental Divide, this project should be completed in 1942.

ASSIGNMENT: R. K. Winters, P. D. Kemp, S. B. Hutchison, and J. M. Honeywell.

STUDY OF PRESENT AND FUTURE REGIONAL REQUIREMENTS FOR FOREST PRODUCTS

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 4. Requirements. A study of present and future regional requirements for forest products.

PURPOSE OF WORK: As part of the national forest survey to determine the current needs for forest products based on present consumption and the trends in use of such products and the underlying causes for such trends.

REVIEW OF PAST WORK: Collected basic data concerning requirements of timber products by railroads, remanufacturing industries, highway departments, public utilities, the mining industry, federal agencies, counties, states, and for farm and urban construction, including also the consumption of fuelwood and fenceposts. Analysis of basic data nearly completed and report preparation begun.

ACCOMPLISHMENTS DURING PAST YEAR: Completed analysis and report published.

PLANS FOR 1941: Project completed.

ECONOMIC ANALYSIS OF FOREST SURVEY DATA IN REPORT FORM

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 5. Interpretation. An economic analysis of forest survey data in report form.

PURPOSE OF WORK: To make an economic analysis of all survey data and prepare final reports by economic units and regions.

REVIEW OF PAST WORK: Preliminary and general analyses made in the forest survey county reports released in connection with the inventory phase. Necessary compilation of inventory and work on requirements, depletion, and growth brought into final stages for northern Idaho. Rough draft of a comprehensive report on the forest resources of northern Idaho begun.

ACCOMPLISHMENTS DURING PAST YEAR: Gathered additional economic data needed for forest resources report for northern Idaho and prepared this report covering all phases of the forest survey. This was reviewed and revised and at year's end was being typed for review in Washington Office. Began work on an economic report on the forest resource situation in Lincoln County, Montana.

PLANS FOR 1941: Complete the report for Lincoln County and prepare one for Ravalli County, Montana, showing forest area and volume statistics and growth and depletion data. Similar reports for some other counties in Montana may be prepared.

DATE OF COMPLETION: A continuing project.

ASSIGNMENT: R. K. Winters,
Forest survey staff.

PERIODIC ADJUSTMENTS OF BASIC STATISTICS

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 6. Keeping Findings Current. Periodic balance of timber books. Current information on forest situation.

PURPOSE OF WORK: To maintain current records of changes in forest inventory due to fire, logging, and other depletion, and to make periodic adjustments of inventory data.

REVIEW OF PAST WORK: Paper adjustments made on basis of existing records without field examination for the northern Idaho report, bringing the inventory data for this area up to January 1, 1939.

ACCOMPLISHMENTS DURING PAST YEAR: Made a field revision of forest type maps in Sanders, Flathead, and Lake Counties to adjust for fire and cutting.

PLANS FOR 1941: None.

DATE OF COMPLETION: A continuing project.

ASSIGNMENT: R. K. Winters,
Forest survey staff.

MANAGEMENT SHORT-GRASS RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Short-grass Ranges

PURPOSE OF WORK: To determine, from the standpoints of the vegetation and economics of production, the best range utilization and management practices for both cattle and sheep.

REVIEW OF PAST WORK: Upswing in total vegetal density has continued quite uniformly at all use intensities since the low point in early 1937 on ranges grazed heavily, moderately, and lightly for 8 years, but the drought effects still overshadow effects of varying grazing intensity. Cactus continues to gain but Sandberg bluegrass declined in 1938 and 1939 after great increases during drought years. In the 7 years, 1933 to 1940 (dry cows used in 1937), the calf crop averaged at weaning 75. 85, and 80.7 percent with aggregate weights of 32,131, 41,079, and 38,727 pounds, respectively, from 20 cows at each intensity. Total feed cost (range plus supplemental) for seven seasons average 4.3, 3.0, and 3.3 cents, respectively, per pound of weaning weight produced. Heavy grazing resulted in a significant financial penalty even before short-grass range forage was perceptibly affected by it.

The number of yearling ewes in each of a series of five pastures has been increased yearly since 1937 to counterbalance rapid recovery of drought stricken ranges. Effects of varying grazing significantly different some seasons but not in others.

ACCOMPLISHMENTS DURING PAST YEAR: Rapid range recovery continued with total density for early 1940 up 83 percent over early 1939 on quadrats in cattle pastures which was approximately 60 percent of 1933 density level. Increase apparently continued through favorable 1940 season. Similar trends noted on sheep pastures. By early 1940 buffalo grass had more than doubled its 1939 density. Grama was a close second. Height growth was about normal or slightly above so that total forage yield in 1940 very near predrought level and range density now near that of 1933.

The one bull plan for 60 cows in six pastures again proved unsatisfactory because the breeding season was lengthened by 50 percent and age range of calves was increased correspondingly. Furthermore, three bulls were used successively. The 70, 85, and 70 percent calf crop of 1940, respectively, was the poorest of any except during drought or the year following a drought year and the need to return to the six bull plan is clearly indicated.

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Total gains of yearling ewes for four seasons, 1937 to 1940, inclusive, have averaged 6.33, 11.03, and 2.36 pounds, respectively (5.7, 9.9, and 2.1 percent) more on pastures K, L, and M, respectively, than pasture J, the most heavily grazed of the series. Pasture N was not stocked in 1940 and pasture M, which has proved itself lacking in uniformity, will be dropped in 1941.

PLANS FOR 1941: The remaining three pastures will be stocked with more sheep to counterbalance range recovery and determine whether stocking at desired intensities will be more clearly reflected by gains and by subsequent production of lambs and wool by these yearlings.

Follow response of vegetation, also cattle and sheep, to weather and intensities of grazing. Increase stocking on three sheep pastures and strive to obtain more uniform utilization and to reduce losses from coyotes by night corralling and otherwise. Discontinue sheep grazing test in 1941, analyze data, and reorganize this sheep range subproject.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurt, E. J. Woolfolk, Clark E. Holscher, and other assistants in cooperation with the B.A.I. and the Montana Agricultural Experiment Station at the U. S. Range Livestock Experiment Station.

January 1941

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RESEARCH METHODS IN RANGE PLANT ECOLOGY

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Research Methods, Range Plant Ecology

PURPOSE OF WORK: Evaluate existing and devise better methods and procedures for measuring response of range vegetation to habitat factors and various treatments.

REVIEW OF PAST WORK: The "decimeter-frame estimate" method of measuring vegetal density on 0.3 square meter plots shown to be most satisfactory of three methods tested for use with series of paired major plots selected as being comparable but located in adjoining pastures. Work on charted meter square quadrats continued with special effort made to improve analysis thereof. Device known as "plot transector" designed and tested in measuring extent of vegetation on plots appears to have considerable promise. Study started to determine relative resistance of blue grama and bluestem wheatgrass to various clipping treatments. Studies made of effect of pasture division fences upon forage density and utilization. Methods of sampling vegetation on experimental pastures studied and improved.

ACCOMPLISHMENTS DURING PAST YEAR: Resurveyed cattle pastures by reconnaissance methods for comparison with 1932 surveys in effort to detect gross changes due to weather or varying grazing use. Also made special survey and map to record browse conditions to detect important increase in sagebrush stand that appears to be developing. Study initiated to determine trends of vegetation and in extent of "slick" spots (areas devoid of vegetation) within experimental cattle pastures. System of forage use classification devised and applied to chart quadrats and density-list plots. Improvements made in utilization surveys and in methods for analysis of data from quadrats, list plots and browse studies.

PLANS FOR 1941: Compare results from plot transector and line transect method as developed in Southwest and use best method for replicated sampling of vegetation to determine trends on plots in different pastures classified previously by condition, i.e., density, composition, soil, etc. Continue efforts to provide more rapid and objective sampling to determine response of range vegetation to treatment.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: R. W. Collins,
E. J. Woolfolk,
C. E. Holscher.

RANGE UTILIZATION STANDARDS

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Short-grass Ranges - Utilization Standards

PURPOSE OF WORK: To develop practicable methods and standards for judging when short-grass ranges are properly utilized.

REVIEW OF PAST WORK: Clipping of paired, protected, and grazed plots tested as a means of measuring forage volume utilized. Results unsatisfactory. Different method developed involving random measurement of stubbles, estimates of percent of plants grazed and development of forage volume curves for key forage species. Comparisons made of forage use by subtypes, pastures, and grazing intensities, within 16 experimental pastures. Gradual improvement made in pasture sampling, methods of plant observation and use of forage volume curves. Some correlation noted between stubble height and weaning calf weights but no simple and satisfactory standard of use yet developed.

ACCOMPLISHMENTS DURING PAST YEAR: Utilization surveys repeated on summer and winter cattle pastures and sheep pastures near close of grazing period. Sampling pattern revised to provide more uniform sampling of subtypes. Observation made on some additional key species and on silver sagebrush to supplement data from key species. Revisions made in field data form to allow for more efficient manipulation of survey data. An additional volume curve constructed from weights of segmented culmless grama clumps. Method improved for adjusting volume curves constructed in previous years to apply to forage produced in 1940. Several short-cuts in field and office procedure discovered and studied as means toward more rapid survey procedure.

PLANS FOR 1941: Continuance of the project with special emphasis upon: (1) more rapid method of survey, (2) minimization of effect of personal bias in plant observation, (3) more accurate methods of determining percent of plants grazed, (4) simplification of survey procedures so as to make them usable by range land managers, (5) further work and improvement in volume curve construction and adjustment, (6) strive to develop usable standard of use through correlation with cattle weights and otherwise.

DATE OF COMPLETION: About 1945.

ASSIGNMENT: E. J. Woolfolk,
R. W. Collins,
C. E. Holscher.

MANAGEMENT SUMMER RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Summer Ranges

PURPOSE OF WORK: Determine best management and utilization practices for summer cattle and sheep ranges, vegetation and economical production both considered.

REVIEW OF PAST WORK: Regular funds are inadequate for research on a full project basis but in addition to certain physical developments financed by CCC and ERA funds several studies have been initiated to develop guides to grazing capacity and season of use for cattle range. Since 1938 an annual utilization survey has been conducted based on measurements of about 4,500 plants, grazed and ungrazed, and use of R-1 Forage Volume Table. The method has been refined and now gives results that justify considerable confidence. In a clipping study, plots that were clipped three times yielded more forage during the first year than those clipped only at the close of the season. This relationship was reversed in 1939 clippings. Quadrats were established in 1939 to study density changes under protection and grazing at two different opening dates.

ACCOMPLISHMENTS DURING PAST YEAR: A motor way, started in 1939, was extended through the experimental range by CCC labor. A more simple method for utilization surveys is to be sought as the data for 1940 are analyzed. Plots that were clipped three times during each of two successive years produced less grass the second than the first year, but those clipped only once yielded 22 percent more during the second year. No seed was produced by Festuca or Poa plants except those that were clipped but once - in the fall. Density trends from quadrats grazed at different opening dates are not yet clear.

Plant development data for both 1938 and 1939 show that 90 percent or more of the culm-producing Festuca and Poa plants up to about 7,000 feet elevation had reached the boot stage by May 25 - about a week earlier than the June 1 opening date. Aspen leaf measurements started in 1940 to supplement other plant development data. Data for 1940 are not yet compiled.

PLANS FOR 1941: Continue development program as funds and CCC labor permit; also continue plant development, utilization, density, and clipping studies. Enlarge protected areas around quadrats established in 1925.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, Paul C. Lemon with other assistance.

METHODS OF ARTIFICIAL REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Revegetation

LINE PROJECT: Methods

PURPOSE OF WORK: Develop low cost methods for the artificial revegetation of depleted or formerly plowed range lands.

REVIEW OF PAST WORK: Low cost methods stressed in plantings made on approximately 1,800 acres of abandoned croplands and unplowed but depleted range lands since 1933. Stands of crested wheatgrass established by broadcasting and disking or by seeding in contour furrows on steep slopes continue to improve in competition with existing vegetation on unplowed but depleted Custer, Helena, Deerlodge, and Beaverhead Forest areas. Many abandoned croplands successfully reseeded without expensive seedbed preparation. Fall seeding more successful than spring seeding for most grasses during drought years; spring dates approximately equal during favorable seasons at 6,200 feet elevation. Spring gave slightly better results than fall plantings for legumes. From 4 to 5 pounds of crested wheatgrass seed per acre appears adequate, planted at a depth of about 1 inch. A firm seedbed is important. A heavy cut-out disk is most satisfactory implement found for use on rocky or brush-covered slopes on unplowed range.

ACCOMPLISHMENTS DURING PAST YEAR: Detailed advice and guidance furnished Bitterroot Forest CCC crews on methods followed in spring and fall planting of 200 acres net on skidroads and burns of recently logged area aggregating about 2,000 acres adjacent to small dependent stock ranches. Preliminary results at Miles City in test of three methods of seeding on three types of seedbeds with four species and one mixture suggest that emergence of seedlings is highest on best prepared seedbeds. Fall reseeding was done on a few acres of an eroding slope at Vigilante terraced by bulldozer and CCC hand labor at an elevation of 8,600 feet. Help was furnished Beaverhead Forest in the reseeding of depleted mountain parks at elevations of 7 to 8 thousand feet. Manuscript prepared for review on "Reseeding to Improve Montana Range Lands," for a Farmers' bulletin.

PLANS for 1941: Complete project analysis and work plans for revegetation studies and undertake further work on cheap methods. Furnish guidance on methods to forests and CCC camps as requested. Report on results of Miles City study of three methods of seeding on three types of seedbeds with four species and one mixture. Observe and report on plantings made in past, particularly those made in 1940.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, L. R. Short, and Gordon D. Merrick.

SITE FACTORS IN ARTIFICIAL REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Revegetation

LINE PROJECT: Site Factors

PURPOSE OF WORK: Determine effect of edaphic, biotic, climatic, physiographic, or other site factors on artificial revegetation.

REVIEW OF PAST WORK: Tentative guide set up as to density of native vegetation which precludes successful seeding of crested wheatgrass. Numerous satisfactory stands established in competition with Bromus tectorum. Reduced soil temperatures due to partial shade an important factor in seedling survival. Limited phosphate fertilizer tests failed to improve forage yield on native and reseeded range. Crested wheatgrass proved drought resistant and tolerant of wide range of soil factors such as texture, mineral content and pH on reseeded areas from 2,300 to 8,600 feet elevation. Crested wheatgrass matured viable seed at 8,600 feet. Weed competition more effective in reducing survival from spring than fall seedings of several species.

ACCOMPLISHMENTS DURING PAST YEAR: In stands of native bunch grasses too dense for successful reseeding without cultivation, more crested wheatgrass became established after plowing and disking than after multiple disking. Poorest stand established after double harrowing. Several forage species seeded to test establishment on previously plowed land abandoned 5 years with dense stand cheatgrass, 3 years with sweetclover, cheatgrass and weeds and also previous season cropping with wheat stubble and Russian thistle. Site selected and prepared for adaptation tests at 9,300 feet.

PLANS FOR 1941: Seed high altitude nursery and continue study of type and degree of competition that defeats reseeding. Prepare map dividing Montana into reseeding zones with similar soil, climate, and other site factors, and develop other phases of site factor study as resources permit.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, Gordon D. Merrick, L. R. Short, and W. Luther Norem.

January 1941

SPECIES AND MIXTURES FOR ARTIFICIAL RANGE REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Revegetation

LINE PROJECT: Species

PURPOSE OF WORK: Test adaptability of certain species and mixtures for revegetation and test grazing value of promising ones.

REVIEW OF PAST WORK: Tests begun 7 years ago showed crested wheatgrass most successful of 20 species tried on wide variety of sites in 24 Montana counties. A few other species and certain mixtures of grasses and legumes showed some promise for range use. Grazing value of crested wheatgrass and native range is being compared for yearling steers and heifers at Miles City. Adaptation "nurseries" were established at Miles City, Missoula, Vigilante, and Thompson Falls, 36 to 107 different accessions planted each place, of which several have proved quite promising.

ACCOMPLISHMENTS DURING PAST YEAR: Range adaptation trial areas were established near Lewistown, Miles City, and Stevensville with fall seeding completed at the first two areas. From nursery trials, 18 species and 5 mixtures were selected and planted near Lewistown, 13 species and 5 mixtures near Miles City. On the Beaverhead National Forest 10 species were planted in mixtures or pure stands on 5 acres of overgrazed mountain parks at about 7,600 feet elevation. Five of the same species in a mixture were broadcast on a steep eroding hillside nearby. On a logged and burned-over area on the Bitterroot National Forest 8 species were planted in the spring on 25 acres and in the fall 10 species in mixtures or pure stands were seeded on 175 acres. In general, the pure stands were seeded on small experimental plots and the mixtures over large areas.

Yearling steers and heifers on crested wheatgrass for 140 days, May 8 to September 25, gained an average of 230 pounds - 1.6 pounds per day. The rate of gain exceeded 2 pounds per day during May, June, and early July but weight losses occurred in late July when the wheatgrass was dry and harsh. Gains were again up to 2 pounds per day during August after good summer rains.

Seeding of Thompson Falls forage nursery completed; Miles City nursery replanted; Vigilante area for adaptation trials at 9,300 feet elevation established.

PLANS FOR 1941: Plant new species, as obtained, in nursery trials; plant most promising from nurseries in range trials, observe range seedings already made. Plant high altitude nursery at Vigilante and Bitterroot range adaptation area near Stevensville early in spring.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, G. D. Merrick, and L. R. Short.

January 1941

COOPERATIVE WESTERN RANGE SURVEY

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Western Range Survey (Region E)

PURPOSE OF WORK: To standardize and systematically assemble range survey data from all agencies in Region E, which includes Montana, ten counties in North Idaho, and four counties in northeastern Washington. The range survey information was to be pooled and made available to all.

REVIEW OF PAST WORK: Range survey maps and grazing capacity estimates were assembled and tabulated for about 7½ million acres in Montana and reports prepared on available but incomplete data for 10 counties during 1937 and 1938. Report for Petroleum County more comprehensive than others. Funds were exhausted and formal work discontinued on June 30, 1938, but requests for information and data are frequently received and filled.

ACCOMPLISHMENTS DURING PAST YEAR: Project dormant except to supply information available.

PLANS FOR 1941: No new work contemplated.

DATE OF COMPLETION: Indefinite - work should be resumed.

ASSIGNMENT: Gordon D. Merrick to supply available data as requested.

FLOOD CONTROL SURVEYS

FIELD DIVISION: Flood Control Surveys

WORK PROJECT: Flood Control Surveys

LINE PROJECT: Preliminary examinations to determine existence of flood problems.

PURPOSE OF WORK: To make preliminary examinations of watersheds to determine existence of flood problems, as specified by the Flood Control Act of 1936, as amended.

REVIEW OF PAST WORK: Project initiated fall 1937, appointment of flood control committee, joint public hearings on Spokane River, Yellowstone River, Clarks Fork River, Kootenai River, and Colville River drainages. Preliminary examination report for the Spokane River drainage made in cooperation with the Bureau of Agricultural Economics and the Soil Conservation Service and transmitted to Washington. Some collection of flood damage and other data was made on the Clarks Fork, Colville, and Kootenai River drainages.

ACCOMPLISHMENTS DURING PAST YEAR: Arthur W. Greeley was employed as working member of the field coordinating committee from January 16 to June 30, 1940. Under general supervision he prepared preliminary examination reports for the St. Regis River and Flathead River drainages, and a work outline for the Spokane River survey. First and second revisions were made on the St. Regis River drainage report and the Spokane River survey work outline by the field coordinating committee. No funds for flood control surveys were allotted to this station for F.Y. 1941, so the work during the last half of 1940 was limited to correspondence and an occasional meeting with members of the field coordinating committee.

PLANS FOR 1941: No work contemplated for first half of 1941 since no funds have been allotted. If funds made available for F.Y. 1942, preliminary examination reports for the St. Regis, the Flathead, and the Milk River drainages will be completed and transmitted to Washington. The work outline for the Spokane River survey will also be completed.

DATE OF COMPLETION: Continuing. Dependent upon allotment of flood control funds.

ASSIGNMENT: Melvin Bradner, in cooperation with representatives of Bureau of Agricultural Economics, Soil Conservation Service, and War Department Engineers.

APPENDIX

PUBLICATIONS

I. PUBLISHED DURING 1940

A. Departmental Bulletins

None.

B. Outside Publications

Davis, Kenneth P.
Economic aspects of managing western white pine forests. Northwest Science 14(2):26-32. May 1940.

Davis, Kenneth P.
In defense of controlled burning and similar public forestry undertakings. Journal Forestry 38(7):592-593. July 1940.

Hagenmeyer, E. F.
Here first aid men needed in logging camps. Timber Topics, vol. 3, no. 4. July-August 1940.

Richards, Leon W.
Effects of certain chemical attributes of vegetation on forest influences. Jour. Agric. Res. 60(12):833-838. June 15, 1940.

Schopmeyer, C. S.
Survival in forest plantations in the Northern Rocky Mountain Region. Journal Forestry 38(1):16-24. January 1940.

Wellner, C. A.
Relationships between three measures of stocking in natural reproduction of the western white pine type. Journal Forestry 38(8):636-638. August 1940.

Whitney, C. N. and S. B. Hutchison
Ties in the Northern Rocky Mountain Region. Cross Tie Bulletin, vol. 21, no. 4. April 1940.

Larsen, Julius A.
Site factor variations and responses in temporary forest types in northern Idaho. Ecological Monographs 10:1-54. January 1940.

Weidman, R. H.
Evidences of racial influence in a 25-year test of ponderosa pine. Jour. Agric. Res. 59:855-868. December 1939.

PUBLICATIONS

I. PUBLISHED DURING 1940

A. Departmental Bulletins

None.

B. Outside Publications

Silv

Davis, Kenneth P.
Economic aspects of managing western white pine forests. Northwest Science 14(2):26-32. May 1940.

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In defense of controlled burning and similar public forestry undertakings. Journal Forestry 38(7):592-593. July 1940.

Prod

Rapraeger, E. F.
More first aid men needed in logging camps. Timber Topics, vol. 3, no. 4. July-August 1940.

Fire

Richards, Leon W.
Effects of certain inflammability chemical attributes of vegetation on forest ~~influences~~. Jour. Agric. Res. 60(12):833-838. June 15, 1940.

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Schopmeyer, C. S.
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"

Weidman, R. H.
Evidences of racial influence in a 25-year test of ponderosa pine. Jour. Agric. Res. 59:855-888. December 1939.

C. Multilithed and Mimeographed Progress Reports

Prod

Anderson, I. V. and E. F. Rapraeger
Highlights of the lumber industry. Forest Industries of the Inland Empire, No. 2. Mult. March 1940.

Survey

Cummings, L. J. and Paul D. Kemp
Forest increment in North Idaho. Forest Survey Release No. 18. Mult. and Mimeog. May 1940.

Silv

Davis, Kenneth P. and Virgil D. Moss
Blister rust control in the management of western white pine. Station Paper No. 3. Mimeog. June 1940.

Prod

Division of Forest Products.
Cedar products prices as of December 1, 1939. (Confidential - not for distribution.) Mimeog. January 1940.

"

Division of Forest Products.
Cedar products prices as of May 1, 1940. (Confidential - not for distribution.) Mimeog.

"

Division of Forest Products.
Cost of manufacturing lumber in Inland Empire sawmills during 1939. (Confidential - not for distribution.) Mimeog. April 1940.

"

Division of Forest Products.
Review of cross-tie specifications as of October 15, 1939. Mimeog. January 25, 1940.

"

Division of Forest Products.
Review of cross-tie specifications as of April 15, 1940. Mimeog.

"

Division of Forest Products.
Lumber selling values since 1913. (Confidential - not for distribution.) Revised April 1940 to include 1939 figures. Mult.

"

Division of Forest Products.
Wholesale lumber prices, fourth quarter, 1939. (Confidential - not for distribution.) Mimeog. January 1940.

"

Division of Forest Products.
Wholesale lumber prices, first quarter, 1940. (Confidential - not for distribution.) Mimeog.

"

Division of Forest Products.
Wholesale lumber prices, second quarter, 1940. (Confidential - not for distribution.) Mimeog.

Prod

Division of Forest Products
Wholesale lumber prices, third quarter, 1940. (Confidential - not for distribution.) Mimeog.

Division of Forest Products
Stumpage transactions in the Northern Rocky Mountain region in 1939. Mimeog. June 1940.

Division of Forest Products
Preliminary 1939 log prices in the Northern Rocky Mountain region. Research Note No. 7. Mimeog. July 1940.

Division of Forest Products.
Preliminary figures on lumber and timber products census, 1939. August 10, 1940. Mult.

Division of Forest Products.
Monthly summary of business conditions in the lumber industry. Issued monthly January-December 1940. Mimeog.

Silv

Division of Silviculture
What to see and where to find it on the Deception Creek Experimental Forest. Mimeog. May 1940.

Fahnestock, G. R. and C. A. Wellner
Early effects of thinning pure ponderosa pine in western Montana. Research Note No. 3. Mimeog. February 1940.

Fire

Gisborne, H. T.
Comparison of intensive versus limited forest fire control action. Research Note No. 10. Mimeog. September 1940.

Range

Hurtt, Leon C. and E. J. Woolfolk
Range production and grazing intensity. Research Note No. 9. Mimeog. August 1940. Also printed in: The Cattleman, October 1940, pp. 109-110. The American Hereford Journal December 1, 1940, p. 21.

Prod

Rapraeger, E. F.
Possibilities of partial cutting in young western white pine. Station Paper No. 2. Mimeog. January 1940.

Rapraeger, E. F.
Christmas tree production in western Montana, 1939. Research Note No. 2. Mimeog. January 1940.

Rapraeger, E. F.
The cubic foot as a national log-scaling standard. Mimeog. January 1940.

Rapraeger, E. F.
Employment per unit of forest product. Research Note No. 11. Mimeog. October 1940.

Schopmeyer, C. S.
Second-year results of direct-seeding experiments in the western white pine type using screens for rodent control. Research Note No. 6. Mimeog. May 1940.

Schopmeyer, C. S.
The use of western red cedar in reforestation by direct seeding. Research Note No. 5. Mimeog. March 1940.

Schopmeyer, C. S.
Successful forestation by direct seeding using poisons for rodent control. Research Note No. 1. Mimeog. January 1940.

Wellner, C. A.
Effects of cleaning in a reproduction stand of western white pine and associates. Research Note No. 4. Mimeog. March 1940.

Wellner, C. A.
Native trees of Montana and northern Idaho. Region One, U. S. Forest Service. Mimeog. May 1940.

Weyedemeyer, Winton, K. D. Swan, and E. F. Rapraeger.
List of the birds of western Montana. Field Notes on Wildlife, U. S. Forest Service, Missoula, Mont. Mimeog. March 1940.

Whitney, C. N. and S. Blair Hutchison
Consumption of timber products in the Northern Rocky Mountain region. Forest Survey Release No. 17. Mult. January 1940.

Whitney, C. N.
Production of lumber and timber products in Idaho and Montana, 1939. Research Note No. 8. Mimeog. August 1940.

II. ESTIMATE OF DEPARTMENTAL PRINTING NEEDS

A. Formal Manuscripts to be Submitted for Departmental Publication Prior to June 30, 1941

Hurtt, L. C.
Management of northern Great Plains ranges to minimize the drought handicap. U. S. Department Agriculture technical bulletin, 40-50 pages, illustrated, 15 pictures, 8 charts. Submitted in December 1940.

Hutchison, S. B.
The forest situation in northern Idaho. U. S. Department Agriculture miscellaneous publication; 50-60 pages, illustrated, 35 charts, 16 pictures.

Schopmeyer, C. S.
Reforestation by direct seeding in the Northern Rocky Mountain region. U. S. Department Agriculture circular; 20-30 pages, illustrated, 2 pictures, 4 graphs.

Short, L. R.
Reseeding to improve Montana range lands. U. S. Department Agriculture farmers' bulletin, 16 pages, illustrated, 15 pictures.

B. Formal Manuscripts to be Submitted for Departmental Publication During Fiscal Year 1942

Rapraeger, E. F.
The cubic foot as a national log scaling standard. U. S. Department Agriculture circular, 16 pages, illustrated.

III. ARTICLES AND OTHER MANUSCRIPTS PROPOSED FOR OUTSIDE PUBLICATION DURING CALENDAR YEAR 1941

Gisborne, H. T.
Adequate fire control for multiple purpose forestry. For Journal of Forestry.

Hayes, G. L.
Some principles of fire behavior distribution and their application in mountainous country. For Journal of Forestry.

Hayes, G. L.
A rain gage for use on mountainsides. For Monthly Weather Review.

Hayes, G. L.
Large log moisture content as an index of seasonal fire danger severity. For Journal of Forestry.

Norem, W. Luther and L. C. Hurtt
Recovery of ranges of southeastern Montana after the 1934-37 drought. For Ecology or Journal of Forestry.

Rapraeger, E. F.
Frontier sawmill. For American Forests.

Rapraeger, E. F.
How wood is used in the metal mines of the Northern Rocky Mountain region. For Journal of Forestry.

Wellner, C. A.
The effect of blister rust on silvicultural practice in the western white pine type. For Idaho Forester.

Wellner, C. A.
A simple method for estimating light intensity beneath forest canopies. For Journal of Forestry.

Whitney, C. N.
Treating fenceposts on the farm. For the Montana Farmer.

Winters, R. K.
Technics of the nationwide forest survey. For University of Washington Forest Club Quarterly.

DIRECTORY OF PERSONNEL

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

January 1, 1941

OVERHEAD ADMINISTRATION

Melvin I. Bradner	Director
Mary J. Pershina	Jr. Administrative Assistant
Dagmar Nelson	Senior Stenographer
Helen B. Davis	Assistant Clerk-Stenographer

FIELD STATIONS

Deception Creek Experimental Forest	Elton E. Bentley
Priest River Experimental Forest	Donald G. McKeever
Miles City Experimental Range	E. Joseph Woolfolk
Vigilante Experimental Range	Paul C. Lemon

DIVISION OF SILVICULTURE

	Mensuration		Regeneration
Charles A. Wellner	20%	Assistant Silviculturist	5%
Clifford S. Schopmeyer		Junior Plant Physiologist	100%
Elton E. Bentley		Head Forest Guard	

DIVISION OF FOREST PROTECTION

Harry T. Gisborne	Senior Silviculturist, In Charge
Paul W. Stickel	Silviculturist
G. Lloyd Hayes	Assistant Forester
Chalmer K. Lyman	Junior Forester
Donald G. McKeever	Junior Forester
Vern L. Cline	Minor Assistant Technician
Bert L. Naiman	Minor Assistant Technician

DIVISION OF RANGE RESEARCH

	Art.Reseed.	
Leon C. Hurtt	20%	Senior Range Examiner, In Charge
Gordon D. Merrick	100%	Associate Forest Ecologist
E. Joseph Woolfolk		Associate Forest Ecologist
Laurence R. Short	100%	Assistant Range Examiner
Robert W. Collins		Junior Range Examiner
Clark E. Holscher		Junior Range Examiner
Paul C. Lemon		Junior Range Examiner
W. Luther Norem	50%	Junior Plant Physiologist
Lester A. Keilman		Assistant Agricultural Aid
George R. Wolstad	20%	Assistant Agricultural Aid
Anthony B. Evanko	20%	Assistant to Technician
Henrietta A. Pissot	25%	Junior Clerk-Stenographer

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DIVISION OF FOREST PRODUCTS

Tim.Har.		Prod.Stat.		Wood P
80%	Elmer F. Rapraeger	10%	Associate Forester, In Charge	10%
	Chester N. Whitney	40%	Associate Forester	60%
20%	Marie E. Bouchard	80%	Assistant Clerk	

DIVISION OF FOREST SURVEY

Robert K. Winters	Senior Forester, In Charge
Paul D. Kemp	Associate Forest Economist
S. Blair Hutchison	Assistant Forest Economist
William L. Royer	Assistant Forester
Jesse M. Honeywell	Field Assistant
Clarence W. Brown	Assistant Technician
Howard B. Hawk	Agricultural Aid
Orlo B. Johnson	Agricultural Aid
Donald L. Axlund	Junior Agricultural Aid
Robert L. Conn	Under Assistant Technician
Melvin E. Metcalf	Under Assistant Technician
Henry J. Pissot	Under Field Assistant
John B. LaCasse	Statistical Draftsman
Montana N. Saldin	Junior Clerk-Stenographer

DIRECT AND INDIRECT COSTS BY FINANCIAL PROJECTS

F. Y. 1941

Financial Project	Indirect Project Costs (Overhead)	Direct Project Costs	Total Costs
Forest Management	$ 3,380	$ 22,370	$ 25,750
Range Research	4,350	28,750	33,100
Forest Products	1,675	10,425	12,100
Forest Survey	4,595	30,405	35,000
Total	14,000	91,950	105,950

DISTRIBUTION OF DIRECT COSTS BY MAIN PROJECTS

F. Y. 1941

Financial and Work Project	Cars, maintenance, & new	Scientific equipment, etc.	Travel expenses other than cars	Salaries Regular	Salaries Temporary	Total
FOREST MANAGEMENT						
Silviculture Inv.	$ 85	$ 319	$ 674	$ 2,497	$2,993	$ 6,570
Mensuration Inv.	15	42	89	329	394	864
Regeneration Inv.		5	12	44	52	116
Forest Fire Protection	90	906	1,185	12,639	____	14,820
Total	190	1,272	1,960	15,509	3,439	22,370
RANGE RESEARCH						
Grazing Management Inv.	400	1,054	786	15,424	2,510	20,174
Artificial Revegetation	60	491	400	7,125	500	8,576
Total	460	1,545	1,186	22,549	3,010	28,750
FOREST PRODUCTS						
Timber Harvesting and Conversion	65	472	350	3,160	405	4,452
Forest Products Statistics	30	550	200	2,460	263	3,503
Wood Preservation	20	10	110	2,330	___	2,470
Total	115	1,032	660	7,950	668	10,425
FOREST SURVEY:						
Survey of Forest Resources, etc.	325	150	3,110	25,770	1,050	30,405
Grand Total	1,090	3,999	6,916	71,778	8,167	91,950

INCREASES NEEDED FOR NEW RESEARCH

Inasmuch as no increases were received in fiscal year 1941 and as the problems and needs are still as they were a year ago, you are referred to this section of last year's annual report, page 80.